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ERRATA

Page 2 15 lines from end for " Douglass " read " Douglas "
,, 47 line 19 for " aflegellate " read " aflagellate "
,, 89 line 22 for " Ball (H. F.) " read " Ball (H. J.) "
,, 100 line 6 for " 2-ethylhexy " read " 2-ethylhexyl "
,, 134 line 1 for " N-propyl " read " n-propyl "
,, 156 7 lines from end for " *Anaclyste* " read " *Anaclysta* "
,, 188 line 27 for " benzene hexachloride " read " γ benzene hexachloride "

COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

REVIEW
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SERIES B.

Vol. 38. 1950.

CROSS (H. F.). **Use of Powders on Clothing for Protection against Chiggers.**—*J. econ. Ent.* **41** no. 5 pp. 731–734, 3 refs. Menasha, Wis., 1948.

In laboratory tests at Orlando, Florida, benzil, p-cresyl benzoate, diphenyl carbonate and 2-thenyl salicylate applied to cloth as 5 per cent. powders in talc at rates equivalent to 100 or 200 mg. toxicant per sq. ft. paralysed Trombiculid larvae in 2–12 minutes. The maximum distance travelled on treated cloth before complete paralysis was 2 ins. After exposure for ten minutes to the lighter dosage of diphenyl carbonate and 2-thenyl salicylate, 73 and 17 per cent., respectively, of the mites recovered, but none survived similar exposure to the higher dosage or to the other powders. In laboratory tests with sleeves treated at the cuffs with barriers of 5 per cent. powders, benzil gave the best protection, allowing only one out of 100 mites placed on the arm of the test subject to attach in three hours when the barrier was 2 ins. wide and none when it was 4 ins. wide; p-cresyl benzoate, diphenyl carbonate and 2-thenyl salicylate allowed 21, 3 and 5, respectively, to attach with the narrow barrier and 0, 1 and 7 with the wider one. The average number of attachments on subjects wearing untreated sleeves was 40.

In field tests with sleeves treated with 2-in. barriers of 3 per cent. powders of benzil, p-cresyl benzoate and diphenyl carbonate, the first gave complete protection and the other two less than 50 per cent. protection. When the arms and legs of the subjects were dusted and barriers were applied around all openings of the clothing, 6 per cent. powders of benzil and diphenyl carbonate gave an average protection for three consecutive days of 95–99 per cent. with 2-in. barriers and 99–100 per cent. with 4-in. barriers. In similar tests in which 4-in. barriers of powders containing 5 and 10 per cent. benzil or diphenyl carbonate were applied, and the interiors of sleeves up to the elbow and trouser legs up to the knee were also dusted, complete protection was afforded for three days. From 30 to 40 gm. powder was used for each uniform. None of the uniforms gave as much as 85 per cent. protection after washing following three days of wear. Uniforms treated over the whole inner surface with 100 gm. 5 per cent. benzil powder (4 gm. per sq. ft.) gave more than 95 per cent. protection for seven days, and the powder was as effective when 165 days old as when fresh. Uniforms treated with 100 gm. 5 per cent. diphenyl carbonate gave less than 95 per cent. protection after the second day of wear. Uniforms treated with 33 gm. of 5 per cent. benzil gave more than 95 per cent. protection for five days. Blowing 8 gm. benzil powder into uniforms while they were being worn gave 99 per cent. protection immediately and after one day of wear. Tests on rabbits indicated that 2-thenyl salicylate is safe for use on the skin, that benzil is suitable for use with caution on clothing at 2 gm. per sq. ft. and the other compounds are safe for use on clothing at 8 gm. It is concluded that powder applications are well suited to the needs of those occasionally exposed to the bites of Trombiculids.

Barrett jr. (W. L.) & Wells (R. W.). **Transplantation of *Hypoderma* Larvae and Testing Chemicals for Control of Larvae in experimental Hosts.**—*J. econ. Ent.* **41** no. 5 pp. 779–782, 4 refs. Menasha, Wis., 1948.

Some of the disadvantages of external application of insecticides to cattle for the control of *Hypoderma* larvae and the need for research to find an insecticide that would be tolerated internally by the cattle and effective in one treatment against the larvae before they reach the back are pointed out. As it is not practicable to experiment with cattle as hosts, the transfer of first-instar larvae of *H. lineatum*, Vill., from the gullets of commercially slaughtered cattle to goats, rabbits and white mice was attempted. The technique is briefly described. Larvae were transferred directly into the subcutaneous tissue of the goats on the thigh or shoulder. Up to 20 per cent. of the larvae implanted in a goat were recovered at necropsy, and all were found in areolar connective tissue. None reached full growth, though some survived in the goats for four months. One larva that hatched from eggs laid on the hind leg of a goat by a captive fly reached the gullet in less than two months. Rabbits were more satisfactory experimental hosts and as many as 85 per cent. of the larvae implanted in the thigh of a rabbit were recovered after 26 days. Larvae transplanted into mice remained in connective tissue for more than a week, but many died during the third and fourth weeks. Mice are especially useful for testing rare and costly chemicals because of their small size.

Some 200 chemicals were tested on first-instar larvae of *H. lineatum* in blood serum, which proved to be a better medium than physiological saline at the concentrations of chemicals tested. However, it is doubtful whether the results obtained in tests *in vitro* are reliable indices of the possible chemotherapeutic action of the compound *in vivo*. During April, May and June 1947, numerous substances were tested in more than 400 infested mice. One substance, eosine Y, was tolerated by mice at 400 mg. per kg. and reached and stained the larvae in loose connective tissue. It appeared to have no selective toxicity, but further tests of water-soluble organic compounds might reveal one that has.

Furman (D. P.) & Douglass (J. R.). **Comparative Evaluations of Insecticides for Cattle Grub Control.**—*J. econ. Ent.* **41** no. 5 pp. 783–787, 6 refs. Menasha, Wis., 1948.

Experiments were carried out in California to compare the effectiveness in sprays against larvae of *Hypoderma bovis*, Deg., and *H. lineatum*, Vill., in cattle of certain currently recommended formulae and new insecticides. The materials and methods used are described. All sprays were applied at a pressure of 350–400 lb. and a rate of 2 U.S. quarts per animal. Sprays of 7·5 or 10 lb. cubé containing 5 per cent. rotenone per 100 U.S. gals. water and the standard spray of 10 lb. 5 per cent. rotenone, 10 lb. wettable sulphur, and 1 U.S. pint detergent per 100 U.S. gals. water all proved moderately effective, but sprays containing 8 lb. 50 per cent. benzene-hexachloride wettable powder containing 5 per cent. γ isomer, 2·5 U.S. quarts 2·5 per cent. rotenone as a liquid extract, 4 lb. 50 per cent. wettable chlordan powder or 1 U.S. gal. 45 per cent. emulsifiable chlordan concentrate per 100 U.S. gals. did not. However, the degree of control obtained with even the best materials was usually not high. In samples of significant size, the best kill (64 per cent.) was obtained with the two formulae containing 10 lb. 5 per cent. rotenone against fifth-stage larvae of *H. lineatum*. Many larvae believed to be dead when examined in the field, proved to be alive when warmed and re-examined in the laboratory. Statistical analysis of the results obtained with the three effective combinations against fourth- and fifth-instar larvae of *H. lineatum* and fifth instars of *H. bovis* considered separately indicated that these stages and species are not all equally susceptible. The fifth instar of *H. bovis* appeared to be significantly more resistant than the fifth instar of *H. lineatum* to two of the three effective formulae. The numbers involved were too small for analysis in the case of the third. Considered on the basis of kill of all larvae, the effectiveness of the mixture containing sulphur was not significantly different from that of the other two, but on the basis of comparative kills of fourth-instar larvae of *H. lineatum* the mixture appeared to be superior to the 5 per cent. rotenone at 7·5 lb. per 100 U.S. gals.

LINDUSKA (J. P.) & MORTON (F. A.). **Tests of the Permeability of Fabrics to Biting by Mosquitoes.**—*J. econ. Ent.* **41** no. 5 pp. 788–794, 2 refs. Menasha, Wis., 1948.

The following is the authors' summary. Of 56 fabrics tested in the laboratory to determine their permeability against biting by mosquitos, nine were practically impervious to biting by *Aëdes aegypti*, L., having allowed fewer than 1 per cent. of the mosquitos to penetrate, and most of the others appeared acceptable from other standpoints for use as protective clothing. Field tests of a number of these fabrics substantiated results found in the laboratory. Suits of Byrd cloth, nylon-filled poplin, Jo cloth, heavy nylon, and one style of cotton twill were found to provide a high measure of protection against biting by mosquitos. Herringbone twill, a fabric commonly used in fatigue uniforms, was only slightly resistant.

A single sample of a calendered nylon fabric showed an appreciably greater resistance to penetration by mosquitos than the same cloth uncalendered. The possibility of reducing porosity of fabrics by mechanical means is suggested.

Samples of 31 fabrics that had been washed three times and then tested dry concurrently with unwashed portions of the same samples gave no significant indication that washing had altered the permeability of the fabrics.

Biting through highly permeable fabrics was eliminated or markedly reduced when such fabrics were removed from direct contact with the body surface by means of coarsely woven, open-mesh netting materials. Laboratory tests of several types of netting worn beneath open-weave fabrics showed favourable results, and indicated that such a combination might prove to be expedient under some conditions.

GAHAN (J. B.), GILBERT (I. H.), PEFFLY (R. L.) & WILSON (H. G.). **Comparative Toxicity of four Chlorinated Organic Compounds to Mosquitoes, House Flies, and Cockroaches.**—*J. econ. Ent.* **41** no. 5 pp. 795–801, 5 refs. Menasha, Wis., 1948.

The following is largely based on the authors' summary of this account of the results of experiments at Orlando, Florida. The effectiveness against *Aëdes aegypti*, L., *Anopheles quadrimaculatus*, Say, *Musca domestica*, L., *Periplaneta americana*, L., and *Blattella germanica*, L., of solutions of chlordan, BHC (benzene hexachloride), chlorinated camphene [toxaphene] and DDT as space sprays and sprays to leave a toxic residue was studied in laboratory and practical tests. In the experiments with space sprays, γ BHC (95 per cent. pure) was about six times as toxic as DDT to *M. domestica* and 2·5 times as toxic to *Aëdes*, as shown by the concentration needed to give 90 per cent. mortality in 24 hours. Samples of chlordan varied in effectiveness, but all were more toxic than DDT to *M. domestica* and less so to *Aëdes*. Toxaphene was considerably less effective than the other three insecticides against *M. domestica* and very much less so against *Aëdes*.

In tests of sprays to leave a toxic residue on plywood of 50, 100, 200 and 400 mg. per sq. ft., DDT was the only compound still causing more than 90 per cent. mortality of *M. domestica* and *Aëdes* exposed for two hours at all dosages after 36 weeks. Chlordan was producing similar results against *M. domestica* at 400 mg. only and toxaphene against *Aëdes* at 200 and 400 mg. When DDT, chlordan and technical BHC (12 per cent. γ isomer) were applied at 200 mg. per sq. ft. to the walls and ceilings of small outbuildings serving as resting places for *Anopheles quadrimaculatus* and *A. crucians*, Wied., few mosquitos were found in the buildings during the first two or three weeks after treatment. In those treated with chlordan or technical BHC, numbers increased after four weeks, but they remained low in the buildings treated with DDT until the observations were terminated after 15 weeks. *A. quadrimaculatus* and *Aëdes aegypti* were found to be about equally susceptible to deposits of DDT, but *Anopheles* was the more susceptible to the other three compounds.

In laboratory tests on adult cockroaches, γ BHC (95 per cent.) was highly effective against *B. germanica* and *P. americana* 1 and 7 days after cloth had been impregnated with it at 200 mg. per sq. ft. and gave very rapid knockdown. Chlordan at the same rate was very effective for 1 and 7 days against *B. germanica* and for one day against *P. americana*, but gave extremely poor knockdown. DDT and toxaphene were relatively ineffective even when freshly applied and caused practically no knockdown, and none of the materials gave a high mortality after four weeks. Chlordan sprayed at 100 mg. per sq. ft. on the walls of two kitchens practically eliminated *B. germanica* almost immediately, and the rooms did not become reinfested during the observation period of eight weeks. A spray of γ BHC at the same rate immediately eliminated an infestation of *B. germanica* in a third kitchen and no reinfestation occurred in eight weeks, but it had very little effect on a light infestation of *P. americana*. Exposure of males of *B. germanica* for two hours on the walls of these kitchens eight weeks after treatment indicated that no very effective deposits of either insecticide remained. Solutions of chlordan and a mixture of chlordan and DDT, when dispersed as aerosols in houses by means of a thermal fog generator, effectively controlled cockroaches (principally *B. germanica*) but a similar treatment with DDT alone was much less successful.

HANSENS (E. J.), SCHMITT (J. B.) & BARBER (G. W.). **Resistance of House Flies to residual Applications of DDT in New Jersey.**—*J. econ. Ent.* **41** no. 5 pp. 802–803, 1 ref. Menasha, Wis., 1948.

The following is based on the authors' summary. House-flies [*Musca domestica*, L.] taken in late August from six barns in New Jersey that had received different DDT treatments during the summer and yet were infested to various degrees were examined for resistance to deposits of this insecticide. Marked resistance to technical DDT and the p,p′isomer was found in flies from the three barns where treatment seemed least satisfactory, and some resistance in flies from the other barns. All flies of the standard laboratory colony that were used for comparison were killed by the deposits tested. All flies, irrespective of source, were killed by deposits of chlordan, chlorinated camphene [toxaphene], parathion or tetraethyl pyrophosphate.

TAYLOR (D. J.), MULRENNAN (J. A.) & THURMAN jr. (D. C.). **Species of Ticks associated with Rocky Mountain Spotted Fever Cases in Florida.**—*J. econ. Ent.* **41** no. 5 pp. 809–811, 8 refs. Menasha, Wis., 1948.

Two cases of Rocky Mountain spotted fever, one of which was fatal, were recorded in Florida in 1947. Brief histories of these and of two suspected cases are given, together with accounts of collections of ticks made at the places where the four children involved were believed to have acquired the infection. Ticks taken in two places in which the confirmed cases occurred comprised, respectively, *Dermacentor variabilis*, Say, and *Amblyomma americanum*, L., and *D. variabilis*, *A. maculatum*, Koch, *Haemaphysalis leporis-palustris*, Pack., and undetermined species of *Amblyomma* and *Ixodes*, and those in the other two places comprised *D. variabilis* only, and *D. variabilis*, *A. maculatum*, *Rhipicephalus sanguineus*, Latr., and *I. scapularis*, Say. *D. variabilis* was thus the only species that was found in all four localities, and it appears on circumstantial evidence to have been the most likely vector [*cf. R.A.E.*, B **35** 35]. *A. americanum* is quite common in Florida, where it infests a variety of hosts including man, and as it is known to be able to carry the disease [*cf.* **32** 45], it is regarded as a potential local vector.

VOGT (G. B.). ***Dermestes* and *Saprinus* as Predators and Pests in Fleshfly Rearing.**—*J. econ. Ent.* **41** no. 5 pp. 826–827, 13 refs. Menasha, Wis., 1948.

During rearing of *Lucilia cuprina*, Wied. (*Phaenicia pallescens*, Shannon) in Texas, the pupae were found to be attacked by larvae of the Histerid, *Saprinus lugens*, Erichs., and larvae and adults of *Dermestes ater*, Deg., and *D. caninus*, Germ., particularly *D. ater*. The conditions under which the flies were being reared are described. Adults of *Saprinus* appeared late in March and the larvae were seen only in April when the sand in the rearing pans was moved for the blowfly pupae to be put into the emergence cages. Between 5 and 10 per cent. of the puparia in the infested pans had been opened and the contents partly or wholly consumed. It was not known whether developing larvae had been attacked earlier. When warmer weather came in May, the Histerid disappeared, without any control measures having been taken. About the middle of July, it was found that 60–90 per cent. of the pupae were being destroyed by *Dermestes*. Most of the damage was done by the larvae. To protect the pupae, it was necessary to cover the tops of the breeding pans with wire screen of 16 meshes to the inch to exclude flying beetles, and to apply grease to the vertical outer sides of the pans to prevent migrating Dermestid larvae from working their way through the screen coverings. The circumstances that caused the Dermestids, usually considered scavengers, to become predacious, are discussed. It is thought that the presence of the fish heads on which the fly larvae were reared attracted them and that when the heads were removed on completion of feeding by the maggots, shortage of food forced the Dermestids to prey on living matter. Puparia of *Musca domestica*, L., were never seen to be attacked by either *Dermestes* or *Saprinus*, although they were often available.

SMITH (W. W.). **Fly Control in a small City by Use of DDT-Oil Mist.**—*J. econ. Ent.* **41** no. 5 pp. 828–829, 1 ref. Menasha, Wis., 1948.

An account is given of the materials and methods used and results obtained in a successful campaign carried out in 1947 in Hattiesburg, a small city in Mississippi, for the control of Muscoid flies by the weekly use, from the last week in June to the last week in October, of 5 per cent. DDT in diesel oil distributed as a mist by a converted power duster mounted on a lorry. In this machine, the solution is forced by a small pump through one or more nozzles into the windblast of the blower, which breaks it up into fine droplets effective for a considerable distance. The mist was directed where desired by moving the flexible windblast tube with a lever. Treatment was applied as the lorry was driven slowly along the streets, and advantage was taken of wind movement to help disperse the mist in the residential sections. The whole surface of the city dump and the vegetation surrounding it were also covered. Treatments were made in the business section early in the morning before much traffic was present, as the mist spotted cars.

Indices to fly populations were computed at places where flies were likely to be most numerous in about ten areas in each section of the city. The number of flies alighting on a wooden grill one yard square after the population had been disturbed by putting the grill in position was counted. Three counts were made at each of three stations, and the highest of these nine counts was taken as the fly index for the area. Averaging the maximum counts from all areas within a section gave the section index, and averaging the maximum counts from all sections gave the city index. Counts were generally made in the afternoon following treatment in the morning or on the day following treatment. Pre-treatment counts were made on four occasions. The pre-treatment index for the city in June made in five sections was 52, the highest section index being 75. The first treatment reduced the city index to 2·7 and weekly treatments thereafter kept it to 2·5 for the remainder of the season. Indices for various sections ranged from 1·9 to 3·2 during this period. Populations recovered rapidly, but the initial pre-treatment index was higher than any pre-treatment index obtained subsequently.

SMITH (W. W.). **Reductions of Fly Indices in the Business District of a small City by the Use of DDT residual Sprays.**—*J. econ. Ent.* **41** no. 5 pp. 829–830, 1 ref. Menasha, Wis., 1948.

An experiment was begun in May 1947 in the small city of Columbus, Mississippi, to test the possibility of reducing the population of Muscoid flies to a level at which it would no longer be a nuisance by applying an emulsified solution of 5 per cent. DDT to garbage, garbage bins and racks, back doors and back walls of buildings in the business section. The emulsion was applied from hand sprayers of the compressed-air type. Basic sanitary measures were maintained unchanged. Ten applications of the emulsion at a dosage of about 200 mg. per sq. ft. were made between 12th May and 1st November. The intervals between treatments were determined by inspections in which the fly index was ascertained by the use of grills [see preceding abstract]. The maximum of three counts at each chosen position was taken, and the figures so obtained for each of ten heavily infested stations were averaged to determine the index for the business section of the city. Additional stations with particularly heavy fly populations were used from time to time. The pre-treatment index was 29·4 and the average of all post-treatment indices obtained throughout the period of the experiment was six.

BATTE (E. G.) & GAINES (J. C.). **Comparison of DDT and Chlordan for the Control of the Horse Louse.**—*J. econ. Ent.* **41** no. 5 pp. 830–831, 1 fig., 2 refs. Menasha, Wis., 1948.

Populations of *Werneckiella* (*Bovicola*) *equi*, L., on horses in Texas are greatest in late winter and early spring, comparatively few individuals surviving the summer heat. The lice concentrate in the forelock and mane and at the point of the withers, and infestation spreads rapidly. The tests described were carried out in the spring of 1948 to compare chlordan and DDT for control of the lice on Shetland ponies. Calculation of dosage-mortality curves was based on the application of an emulsion concentrate containing 40 per cent. technical chlordan, 10 per cent. pine oil and emulsifying agents diluted to contain 0·03–0·1 per cent. chlordan and of sprays made from wettable powders at 0·05–0·2 per cent. chlordan or DDT. The sprays were applied with an electric hand-sprayer at 1 U.S. quart to each animal. Counts were made before and after treatment on an area of 4 sq. ins. on each side of each animal. The concentrations required for 50 per cent. mortality were 0·043 per cent. chlordan in emulsion, 0·081 per cent. chlordan as wettable powder and 0·099 per cent. DDT as wettable powder. The chlordan powder became more effective than the DDT at concentrations above 0·075 per cent. The emulsion caused no injury to the animals and killed all the lice at concentrations above 0·15 per cent. chlordan. The wettable powders are considered safer, and in this form either chlordan or DDT will give economical control.

PRATT (H. D.) & McCAULEY jr. (R. H.). **Two interesting Tick Records from Georgia.**—*J. econ. Ent.* **41** no. 5 p. 832, 1 fig., 5 refs. Menasha, Wis., 1948.

Many individuals of *Dermacentor albipictus*, Pack., mostly males, were found on a Virginia deer shot in November 1947 near the coast of Georgia. This is believed to be the first record of *D. albipictus* from that State. The same deer was heavily infested by *Ixodes scapularis*, Say, 19 copulating pairs of which were seen on it. Many males appeared to be pairing with unengorged females.

BOHART (R. M.). **A Comparison of DDT and Dichlorodiphenyl Dichlorethane as Larvicides for *Aëdes* Mosquitoes.**—*J. econ. Ent.* **41** no. 5 pp. 834–835, 5 refs. Menasha, Wis., 1948.

In laboratory tests against larvae of two pest species of *Aëdes* collected in salt marshes in central California, 20 per cent. solutions of technical grade DDT or DDD (dichlordiphenyldichlorethane) in xylene containing 10 per cent. emulsifier (Triton X-100) were added to distilled water to which young fourth-instar larvae were then transferred. The temperature of the water was about 23°F. and mortality counts were moderate after 48 hours, DDD was 2–3 or more times as toxic as DDT, according to the concentration used, and *A. squamiger*, Coq., was much more resistant to both insecticides than was *A. dorsalis*, Mg. The median lethal doses of DDT and DDD were about 1 : 30 million and 1 : 100 million, respectively, for *A. squamiger* and 1 : 200 million and between 1 : 400 million and 1 : 800 million for *A. dorsalis*. DDT at 1 : 10 million and DDD at 1 : 20 million gave 93·8 and 100 per cent. mortality, respectively, of *A. squamiger* and DDT at 1 : 30 million and DDD at 1 : 200 million gave complete mortality of *A. dorsalis*. DDD has been considered as a substitute for DDT where danger to man, domestic animals or wild life may be important, in view of its lower toxicity to vertebrates. As *A. squamiger* and *A. dorsalis* often occur separately, the dosage of larvicide can in such cases be adapted to the species present.

BETTINI (S.). **Sul contenuto proteico di riserva dei corpi grassi delle femmine di *Anopheles labranchiae* var. *atroparvus*.** [The Protein Reserves of the Fat-bodies of Females of *A. maculipennis* var. *atroparvus*.]—*Riv. Parassit.* **8** no. 1 pp. 45–52, 1 fig., 8 refs. Rome, 1947. (With Summaries in English and French.)

An account is given of experiments in Italy in January–May 1946 showing that larvae of *Anopheles maculipennis* var. *atroparvus*, van Thiel (*labranchiae* var. *atroparvus*) fed on grain infusion usually accumulated little protein in the fat-body during development. The females to which they gave rise contained very little and accumulated hardly any after feeding on guineapig blood, even when kept at low temperature. The protein stored by the larvae is probably used up in the pupal stage, and that ingested by the females in maturing their eggs. This is in marked contrast to the autogenous biotype (*autogenicus*, Roub. [*cf. R.A.E.*, B **21** 267; **35** 119, etc.]) of *Culex pipiens*, L., in which the larvae accumulate protein and pass it to the adults, which use it to mature eggs [*cf.* **18** 94].

SACCÀ (G.). **Revisione dei *Phlebotomus* della collezione Rondani: un punto fermo sulla questione del *P. minutus*.** [A Revision of the *Phlebotomus* of the Rondani Collection: a Note on the Question of *P. minutus*.]—*Riv. Parassit.* **8** no. 1 pp. 53–62, 7 figs., 10 refs. Rome, 1947. (With Summaries in English and French.)

The author describes three specimens of *Phlebotomus papatasi*, Scop., and eight of *P. minutus*, Rond., from Rondani's collection now in Florence, discusses the characters of the latter and agrees with the views of Parrot on its identity and synonymy [*R.A.E.*, B **31** 245].

KAHN (M. C.). **Female Mosquito "Calls" and their possible Significance in Control.**—*Rev. Kuba Med. trop. Parasit.* **3** no. 5 pp. 119–120. Havana, 1947.

Since the antennae of male mosquitos are heavily haired, while those of the females bear only sparse or rudimentary hairs, it was thought possible that the male antennae might serve as receptors for sounds produced by the females. Records were made of the sounds produced by *Anopheles quadrimaculatus*, Say, *Aëdes aegypti*, L., *A. albopictus*, Skuse, and *Culex pipiens*, L., all maintained in the laboratory at Cornell, by placing the mosquitos in a sound-proof chamber and using an electrical apparatus comprising a sensitive microphone, very powerful amplifier, suitable band pass filters, and a high-quality disk with a sapphire needle. Sounds were produced by all the species, but they were inaudible to the human ear unless amplified 100 million times or more. Each species emitted tones that were quite distinctive, and males and females of the same species also produced sounds that were distinct. Some sounds were like bird calls, others appeared to be mating calls, females appeared to make a special sound when requiring a blood-meal, and sounds of apparent anger were elicited by wetting the mosquitos. All the sounds recorded were within the range of 200–8,000 cycles per second. When the call of a single female was recorded and played back to the males, the latter answered in chorus and most of them flew towards the source of the sound. If they were in a small test-tube, their antennae and hypopygia turned in the direction of the sound. Certain individuals produced two tones separated by a small interval in pitch. It was not discovered how the sounds were produced, but they were not wing noises. It was proposed to use the finding in the field in an attempt to attract male mosquitos to an electrocuting device.

AGUIRRE PEQUEÑO (E.). **Presencia de *Trypanosoma cruzi* en mamíferos y triatomídeos de Nuevo León, Monterrey, México.** [The Presence of *T. cruzi* in Mammals and Triatomines in Nuevo León, Monterrey, Mexico.]—*Rev. Kuba Med. trop. Parasit.* **3** no. 5 pp. 120–121, 12 refs. Havana, 1947.

Four of seven adults and 20 of 32 nymphs of an unidentified species of *Triatoma* taken in the huts of a small mining community at Los Ramones, in the State of Nuevo León, Mexico, in 1946 were found infected by *Trypanosoma cruzi*. In investigations on the animal reservoir, 47 of 65 opossums (*Didelphis* *mesamericana*) taken in that and a neighbouring locality were shown to be infected. These are the first records of natural infection in the State.

Elishewitz (H.). **Epidemic Control with DDT, ANTU and 1080.**—*Soap & sanit. Chem.* **23** no. 5 pp. 127–129, 151 ; no. 6 pp. 153, 155, 157, 159, 193, 18 refs. New York, N.Y., 1947.

Recent experience in various parts of the world has shown that outbreaks of murine typhus and plague can be prevented or controlled by the use of one or other of two new rat poisons and the control of fleas on rats with DDT, preferably as a dust [*cf. R.A.E.*, B **35** 192 ; **36** 112, 178, 200 ; **37** 217]. The manner of using the DDT and equipment for dispensing it are discussed in relation to the habits of the fleas. These occur on their rodent hosts, in their breeding places (which are often the nests of the rodents) and living free in the open seeking a host. It is when they are in the third situation that the danger to man is most immediate. Control is best directed against fleas in all three types of habitat, and should be carried out before poison baits are laid down for the rats, to prevent migration of the fleas from the dead rats to man. The first situations to be treated are floors (including spaces under, behind and around all movable objects and under rugs and animals' sleeping places), chairs and stuffed furniture, clothing and rodent runways. Special attention should be given to corners and the junctions of wall and floor and to cracks and holes in the floor. The next places to be treated are hidden nesting places of rats, spaces between walls, under floors, in gutters, etc., and finally runways of rats and wild rodents beneath or round houses or in the fields. Dusts should be applied at a rate of at least 50–100 mg. DDT per sq. m., 200–250 mg. generally being recommended in practice, and should not be swept up for 5–7 days after application. Treatment should be repeated monthly during epidemics and every three or four months or when flea indices show an increase at other times.

Doner (M. W.). **Testing Insecticide Residues. A Review of Methods.**—*Soap & sanit. Chem.* **23** no. 6 pp. 139, 141, 143, 193, 1 ref. New York, N.Y., 1947.

The problems that arise in testing the persistent toxicity of insecticide deposits to flies [*Musca domestica*, L.] and some of the methods in current use are discussed on the basis of a study of procedure followed in 19 laboratories. The methods adopted by the author are then described. A standard insecticide is used for comparison as in the Peet-Grady method [*R.A.E.*, B **37** 5] so that it is possible to assign a plus or minus value to the deposit being evaluated. Two methods of assessing knockdown efficiency are used. In the first, the average times required for the unknown and the reference insecticide to knock down 50 per cent. of the flies on each date of testing are plotted on a graph, and the age of the deposit at which 60 minutes' exposure would give 50 per cent. knockdown is taken as the point of comparison. The unknown is given a plus or minus rating according to whether this age is greater or less for it than for the reference insecticide. The second method is based on the difference in the age of the deposit at which the reference insecticide and the unknown knock down 50 per cent. of the test insects when the exposure period is the same as that in which the reference insecticide knocked down the last of all the flies on the first date of the test. Ratings are assigned as in the first method. The second is much easier because of the standard exposure period. The killing efficiency of a deposit is determined 24 hours after exposure for a period that is just sufficient to result in complete kill of flies with each of the three types of formulations (wettable powders, emulsions and solutions) on the first day of the test. A plus or minus rating is assigned to the insecticide under test according to whether it causes 50 per cent. mortality after or before the reference insecticide.

Holmes (F. O.). **The filterable Viruses.** Supplement No. 2, Bergey's Manual of determinative Bacteriology, Edition VI, 1948, with revised and enlarged Index.—$9\frac{1}{4}\times6$ ins., pp. [3+] 1127–1286, i–xxiii. Baltimore, Md., Williams & Wilkins Co., 1948. Price $ 2/50 cts.

The author has extended his binomial classification of viruses [*R.A.E.*, A **29** 437; **38** 8] to include those that infect animals but have no plant hosts, so far as known. These are arranged under 15 genera in six families. They are classified according to the symptoms produced, and the information given on each one comprises its common name, hosts and distribution, the symptoms caused, and its mode of transmission (including Arthropod vectors), serological and immunological relationships, and physical and other properties.

Melnick (J. L.) & Penner (L. R.). **Experimental Infection of Flies with Human Poliomyelitis Virus.**—*Proc. Soc. exp. Biol. Med.* **65** no. 2 pp. 342–346, 3 figs., 11 refs. New York, N.Y., 1947.

Non-biting flies collected during epidemics of poliomyelitis in different types of environment in various parts of the United States and Canada have been found to harbour the poliomyelitis virus [*R.A.E.*, B **33** 110, etc.]. Experiments designed to indicate whether the virus could survive and multiply in flies have been made by three groups of workers, but they all used simian- or murine-adapted strains, and only Bang & Glaser [**32** 42] used flies other than *Musca domestica*, L. These virus strains survived for up to two days in *M. domestica* and the one used by Bang & Glaser was not recovered from the other flies; the 12-day survival of the virus of a strain of spontaneous mouse encephalomyelitis recorded by the latter authors is of doubtful significance, because this virus has no established relation to that of human poliomyelitis. In the present work, flies were allowed to feed on virus naturally present in the faeces of poliomyelitis patients. *Phormia regina*, Mg., was used because, with *Lucilia* (*Phaenicia*) *sericata*, Mg., it has been represented in all positive batches of flies from epidemic areas tested in the authors' laboratory, it is attracted to faeces as well as to common foods, and it was the only positive species found in tests for virus carried out on the four most prevalent kinds of fly (including *L. sericata* and *M. domestica*) during an epidemic in Illinois in 1945.

As control experiments, *Phormia regina*, *L. sericata* and *Sarcophaga bullata*, Parker, were infected with murine-adapted strains of virus and a spontaneous encephalomyelitis virus of mice as it naturally occurs in the intestinal contents of laboratory mice. In these experiments, virus could often be recovered within 72 hours of feeding from the bodies and excreta of the flies. It appeared that virus could be isolated from the abdomen more readily than from the head or thorax. Occasional tests from any part of the fly were positive from the third to the end of the fifth days, but none yielded virus after this, and results with a biologically inert material (carmine) were similar. No differences were detected when different species of flies or strains of virus were used.

When *Phormia regina* was fed on human poliomyelitis virus, the results were markedly different. In the first experiment, 20 flies were fed once on a preparation of virus from the faeces of patients, and kept at temperatures alternating between 10 and 25°C. [50 and 77°F.]. A pool tested 12–16 days after the infective meal was positive in one out of four monkeys, but one tested 19–22 days after it was completely negative. Excreta collected before the virus feeding and five days after it were negative, but samples obtained 7–9, 12–16 and 19–22 days after the infective meal all gave positive results. In a second experiment, 200 flies were used ; they were kept at a constant temperature of 27°C. [80·6°F.]. Their excreta were positive on the day following feeding and on the third day, but negative 4, 5–8 and 9–12 days after feeding. A sample of 50 flies taken within 24 hours of feeding on virus was positive, and one of the monkeys receiving another sample taken 5–12 days after feeding developed typical experimental poliomyelitis, but samples taken 2, 3 and 4 days after feeding were negative.

The difference in persistence between the murine and the human strains cannot be explained on the basis of titre of infective material. Too few test monkeys were used to place significance on negative tests followed by positive ones. The result, if any, of the cyclic temperature variation in prolonging the persistence of virus in the fly cannot be evaluated on the basis of the available data. The results are compatible with the multiplication of the virus in the fly, but this has not been proved to occur.

HAYES (W. P.) & LIU (Yu-Su). **Tarsal Chemoreceptors of the Housefly and their possible Relation to DDT Toxicity.**—*Ann. ent. Soc. Amer.* **40** no. 3 pp. 401–416, 63 figs., 15 refs. Columbus, Ohio, 1947.

The following is based on the authors' summary. A detailed histological study was made of the tarsi of adults of *Musca domestica*, L., which are very susceptible to DDT, adults of *Blattella germanica*, L., and adults and larvae of *Epilachna varivestis*, Muls., which are less susceptible. The cuticula, hypodermis and basement membrane form the wall, while the trachea, an unguitractoral tendon and a pair of nerves occur within and run throughout the tarsal segments. On the cuticula, there are several kinds of appendages, such as the spines, fixed hairs, tactile setae, tenent hairs and chemoreceptive setae.

Among the three species studied, chemoreceptive sensillae were found only on the tarsi of *M. domestica*. They are situated latero-ventrally on the second to fifth tarsal segments and were not found either on the dorsal side of those segments or on the first tarsal segment. The chemoreceptive organ is composed of a group of sense cells situated in a sub-epidermal position and covered by a nucleated neurolemma continuous with that of the longitudinal nerve. The individual cells are more or less spindle-shaped. The sensillae are attached at the distal end to a long, thin-walled chemoreceptive seta.

The thickness of the cuticula was 12·5–25 μ in *M. domestica*, 25–45 and 15–40 μ in adults and larvae of *E. varivestis*, and 60–90 μ in *B. germanica*. Thus, it may be said that in general *M. domestica*, which is highly susceptible to DDT, has a thinner cuticula than the less susceptible species tested.

MUNSON (S. C.) & YEAGER (J. F.). **The Relation between Poison Concentration and Survival Time of Roaches injected with Sodium and Potassium Cyanides and Potassium Ferricyanide.**—*Ann. ent. Soc. Amer.* **40** no. 3 pp. 475–488, 2 figs., 5 refs. Columbus, Ohio, 1947.

The following is substantially the authors' summary. The relation between concentration and survival time and between concentration and recovery time was studied for large nymphs of *Periplaneta americana*, L., into which solutions of sodium cyanide, potassium cyanide or potassium ferricyanide had been injected. The potassium salts facilitated haemorrhage, thereby increasing experimental error. The course of symptoms in the poisoned cockroaches was compared with that in cockroaches poisoned with sodium metarsenite, which was used as a standard. The curves obtained by plotting time after injection against symptomatic stages of incapacity are complicated in the case of the cyanides by the fact that these compounds have both a narcotic and a lethal effect upon the insects into which they are injected. Whereas deterioration in the condition of cockroaches into which arsenite has been injected is progressive from the onset of symptoms until death, cockroaches into which cyanide has been injected may become completely inactivated (narcotised), recover partly or completely and eventually die after showing a succession of symptoms. The cyanides produce tremors temporarily, particularly during the early stages of poisoning. The curve obtained when concentration of a cyanide is plotted against survival time is complicated not only by the occurrence of both narcotic and lethal effects but also by the existence of two critical zones, one for narcosis and one for death, and by the presence of a region of inflection analogous to the inflection in curves for cockroaches into which arsenite has been injected [*cf. R.A.E.*, B **33** 25; **35** 50]. Thus, these cyanide curves are composite, representing time for complete narcosis at the upper concentrations and survival time at the lower lethal concentrations. At the intermediate concentrations, they are transitional. These complexities render mathematical treatment of the data difficult. Potassium ferricyanide appears to be less toxic than potassium cyanide or sodium cyanide to *Periplaneta*, possibly because of considerable stability of the ferricyanide radical.

NEWKIRK (M. R.). **Observations on *Megarhinus splendens* Wiedemann with Reference to its Value in Biological Control of other Mosquitoes (Diptera: Culicidae).**—*Ann. ent. Soc. Amer.* **40** no. 3 pp. 522–527, 6 refs. Columbus, Ohio, 1947.

As females of *Megarhinus splendens*, Wied., do not attack man and the larvae feed on those of other mosquitos, its use in biological control has been attempted [*cf. R.A.E.*, B **19** 216; **22** 94; **30** 83]. The author made some field observations on this species during 1944 and 1945 in New Guinea and the Philippine Islands where it bred largely in artificial containers, tree holes and leaf axils and had a high mortality in the immature stages, probably attributable to cannibalism. The larvae appeared to be far more sparsely distributed than those of other mosquitos on which they might be predacious and were only once found in a ground pool. He also gives details of laboratory studies made in New Guinea in 1944 in which it was found that *M. splendens* has a long life-cycle (probably about four weeks), produces very few offspring (about 60 eggs in each batch) and has a low survival rate, largely on account of cannibalism. He concludes that these characters make it unlikely to exercise effective control of other mosquitos.

BERNER (L.). **Notes on the Breeding Habitats of *Aedes* (*Stegomyia*) *aegypti* (Linnaeus).**—*Ann. ent. Soc. Amer.* **40** no. 3 pp. 528–529. Columbus, Ohio, 1947.

Attempts to control or eradicate *Aëdes aegypti*, L., are nearly always based on the assumption that the immature stages develop only in man-made breeding places [but *cf. R.A.E.*, B **35** 185; **36** 205; etc.]. During work in the Gold Coast, however, larvae of *A. aegypti* were found in natural breeding places of many types, including tree holes, water in the axils of a banana tree, rock pools, small ground pools in protected places and pools formed in earth drains. P. F. Mattingly found it breeding in grass-bottomed and grass-sided drains, and G. M. Findlay reported in a personal communication that it had been seen breeding on mud tops of African houses and in footprints. In view of these records from water standing in earth, attention is drawn to references in the literature where breeding is stated not to occur in such places.

FERGUSON (F. F.), ARNOLD (E. H.) & UPHOLT (W. M.). **Control of Anopheline Mosquito Larvae by Use of DDT-Oil Mists.**—*Publ. Hlth Rep.* **62** no. 9 pp. 296–302, 7 refs. Washington, D.C., 1947.

The results are given of tests in Georgia of the effectiveness against larvae of *Anopheles quadrimaculatus*, Say, of mist sprays of oil containing DDT. No. 2 fuel oil was used as the solvent and 0·5 per cent. B-1956 [a phthalic glyceryl alkyd resin] was added to improve spreading power. The spray could be dispersed at 1 U.S. gal. per acre with a light-weight agricultural sprayer of the air-pressure type with a hand-pump to build up pressure and a bronze atomising nozzle of small capacity producing a fine mist spray. The mass median diameter of droplets over a swathe 30–40 ft. wide was 100–125 μ with wind blowing at 2·5 miles per hour. In tests in which the amounts of solvent applied per acre were 0·5, 1 and 2 U.S. gals. and the amounts of DDT were 0·025, 0·05 and 0·1 lb. in each case, all dosages gave a high initial kill of larvae of all instars but had little effect on pupae. Reinfestation by first-instar larvae was generally evident by the third day, but 10–12 days may elapse before many fourth-instar larvae are present. At 0·1 lb. per acre, DDT was equally effective in 1 U.S. gal. oil applied as a mist and in 15 U.S. gals. emulsified solution applied with a knapsack sprayer, but the mist-spray method effected a considerable saving in manpower and fatigue and also in cost of materials. Applications in the range of 0·05 lb. per acre are recommended where there is danger of harm to fish by the higher dosage [*cf. R.A.E.*, B **37** 219]. The recommended formula is 0·625 per cent. DDT and 0·5 per cent. B-1956 in No. 2 fuel oil applied at 1 U.S. gal. solution per acre.

UPHOLT (W. M.). **The Inactivation of DDT used in Anopheline Mosquito Larvicides.**—*Publ. Hlth Rep.* **62** no. 9 pp. 302–309, 1 fig., 3 refs. Washington, D. C., 1947.

When DDT is applied in various ways for the control of Anopheline larvae at dosages that are adequate to give high initial mortality and are reasonably harmless to other aquatic fauna, its toxicity is lost completely in 1–2 weeks. An account is given of an investigation of the causes of the loss of effectiveness and the following is substantially the author's summary of the results. Several factors may contribute to the loss. The two most important appear to be clearing of a DDT film from part of the water by wind and wave action, and precipitation of suspended DDT and its adsorption by some part of the bottom-mud complex [*cf. R.A.E.*, B **35** 13, 15]. Adsorption is relatively slow on mud and appears to be on the organic components only ; sandy soils with a minimum of organic material are rather poor adsorbents. It has been suggested that if it were possible to find a non-toxic substance more readily adsorbed than DDT, it could be mixed and applied with it, and by being more rapidly adsorbed prevent the adsorption of the DDT itself.

RAGHAVACHARI (K.), ABBAS ALI SHAH & RAY (H. N.). **Control of Acute Theileriasis in Calves in the Punjab.**—*Indian J. vet. Sci.* **15** pt. 2 pp. 149–151, 1 pl., 2 refs. Delhi, 1946.

In May 1940, a severe outbreak of a disease caused by an organism provisionally identified as *Theileria annulata* occurred in calves less than three months old on a farm in the Multan district of the Punjab. The disease had been prevalent from March to September in 1936–39, when it had caused annual losses of 13–23 per cent. among calves on the farm ; in 1940, the death rate had reached 10 per cent. by June. The pathology and symptoms are described. The vector is a species of *Hyalomma* (here considered to be *H. aegyptium*, L. [but *cf. R.A.E.*, B **24** 196]), with which the farm was found to be extensively infested. It is stated that one of the authors (Ray) has shown that this tick is responsible for transmitting acute theileriasis to young calves and that the infection is transmitted hereditarily in the adult stage but not in the larval or nymphal stages [*cf.* **33** 16].

Newly born calves weaned at birth were protected by keeping them in an enclosure that had been freed from ticks by digging the earth to a depth of about 18 ins. and burning dry leaves and grass over it and made proof against reinfestation by a moat about 9 ins. wide and 6 ins. deep filled with water. Calves detained here for three months were susceptible to infection when removed to an infected area, but none died. To protect calves not weaned at birth, ticks were picked by hand from the cows when these were in an advanced stage of pregnancy, the cows were kept half a mile away from the main herd, and their tails and ears were dipped and the rest of the body sprayed every three days with a solution of 17 oz. sodium arsenite in 50 gals. water in which 18½ oz. liquid paraffin was emulsified with 11 oz. soft soap. A few weaned calves less than two months old were dipped in this solution. These measures were highly effective, and the results of a preliminary test in which calves that had been vaccinated with a suspension in 5 per cent. formalin of lymph glands and spleen from an infected animal were exposed to ticks were very promising.

SAPRE (S. N.). **Transmission of Pasteurellosis by the Fleas** (*Ctenocephalides felis*).—*Indian J. vet. Sci.* **15** pt. 2 pp. 151–155, 11 refs. Delhi, 1946.

Since *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., which is common on cattle and young buffalos in the United Provinces, has been shown to transmit bovine haemorrhagic septicaemia (pasteurellosis) to laboratory animals [*cf. R.A.E.*, B **23** 83] and the disease in nature is generally associated with an increase of fleas, experiments were carried out to verify the ability of *C. felis* to transmit the organism among rabbits and to ascertain whether it can do so to buffalos. Batches of fleas collected from dogs 12 hours previously were placed on the clipped abdomen of a rabbit with numerous bipolar bacteria in the blood and kept on it till half an hour after its death. They were then kept without food for 6–48 hours and transferred to an uninfected rabbit. The results of 12 out of 15 experiments were positive, and transmission was effected by as few as two fleas. On the other hand, in 11 experiments on transmission to buffalos using up to 3,000 fleas, eight failed completely, one (with 1,600 fleas) was positive and two were inconclusive. As the results were predominantly negative in spite of optimum conditions as regards number of fleas and virulence of the organism, it is considered unlikely that haemorrhagic septicaemia in bovines is transmitted by *C. felis* in nature. The organism was found in the faeces of fleas fed on infected rabbits and then kept without food for 48 hours, and also in the bodies of infected fleas that had fasted for 112 hours. The disease was transmitted to a healthy rabbit by rubbing infected flea faeces into the wounds made by the bites of healthy fleas.

SREENIVASAN (M. K.) & RIZVI (S. W. H.). **Demodectic Mange of Goats in India.**—*Indian J. vet. Sci.* **15** pt. 4 pp. 287–289, 1 pl., 8 refs. Delhi, 1946.

In July 1944, kids born at Mukteswar of goats originating from various scattered localities in the United Provinces and recently acquired in a market were found to have mange-like eruptions on and under the ears, but scrapings were negative for mites. Examination of all the 45 goats showed that two had squamous itch on the surface and border of the ears and one showed nodules on the face and neck. The material from both types of lesions contained *Demodex caprae*, Raill., which has not previously been recorded from India. The three infested goats were removed from the herd, but three others were later found to be infested. Of 500 other goats at the market subsequently examined, a few from the Farukhabad and Etah districts of the United Provinces also had demodectic mange. The three types of lesions seen are described. *Demodex* was transmitted to four out of six healthy goats by applying fresh infective material to both sides of the neck up to the bases of the ears after closely clipping or shaving the hair. Two applications were made at intervals of a week. The minimum time in which signs of infestation developed was four months. Lesions did not develop at the site of application of the infective material, which may have been due to the clipping or shaving. Three kids born about five months after the experimental infestation of the mothers did not show infestation three months later. In the artificial infestations, unlike the natural ones, the lesions were small and non-progressive, which may have been due to the good condition of the goats, and in one animal, they disappeared in about nine months. Occasional contact with infested animals did not result in infestation. An attempt was made to infest bulls with the *Demodex* from goats and one developed nodules, but the mites in it proved to be cattle *Demodex* [*D. bovis*, Stiles].

MACKERRAS (I. M.) & POPE (P.). **Experimental *Salmonella* Infections in Australian Cockroaches.**—*Aust. J. exp. Biol. med. Sci.* **26** pt. 6 pp. 465–470, 2 figs., 8 refs. Adelaide, 1948.

During an epidemic of salmonellosis in Brisbane, two species of *Salmonella* were found in cockroaches, one in *Periplaneta americana*, L., and the other in *Nauphoeta cinerea*, Ol. As cockroaches abound in Brisbane, live many months and move freely from place to place, experiments were made to determine whether they could be infected readily with *Salmonella* and for how long they would retain an infection. The methods are described. Four species of cockroaches found in Brisbane houses and five species of *Salmonella* that had been isolated during an outbreak of gastro-enteritis were used, and each species of cockroach became infected with each species of *Salmonella* given to it in food, *Supella supellectilium*, Serv., and *N. cinerea* being thus infected with four species, *P. australasiae*, F., with five, and *P. ignota*, Shaw, with two. Altogether, 37 out of 49 cockroaches became infected, and the bacteria were isolated either from their faeces during life or from the gut after death. Recovery of *Salmonella* from the faeces was irregular. Eight cockroaches retained their infections for at least 13 days, and one (*N. cinerea*) excreted viable *Salmonella* 40 days after infection. Infected cockroaches showed no obvious effects. There was a significantly higher mortality in the first week of infection than later, and higher mortality among infected individuals than among controls, but the numbers involved in the latter case were not adequate for statistical treatment. Laboratory colonies became infected if they had access to cultures of *Salmonella*, but infection did not spread from an infected individual to uninfected members of a colony. It is concluded that as cockroaches feed readily both on faeces and food, their capacity to spread salmonellosis is considerable.

MACKERRAS (M. J.) & ERCOLE (Q. N.). **Observations on the Life-cycle of *Plasmodium malariae*.**—*Aust. J. exp. Biol. med. Sci.* **26** pt. 6 pp. 515–519, 3 figs., 6 refs. Adelaide, 1948.

Females of *Anopheles punctulatus*, Dön., that had fed in New Guinea on a child who had gametocytes of *Plasmodium malariae* in the blood were flown to Queensland, when some were dissected at intervals and others infected a man on whom they fed repeatedly 24–34 days after acquiring the infection. The mosquitos were kept at a mean temperature of 73°F. ; oöcysts, which differed little in size or stage of development, were found in two dissected after 16 and 26 days' incubation and sporozoites in one dissected after 31 days. The life-cycle in the mosquitos was thus about four weeks, whereas *P. vivax* and

P. falciparum developed in 15–16 and 18–20 days in concurrent batches [*cf. R.A.E.*, B **37** 142]. The development of the parasite in the infected man and in two others infected by subinoculation of trophozoites is described.

LEES (A. D.). **Transpiration and the Structure of the Epicuticle in Ticks.**—*J. exp. Biol.* **23** no. 3–4 pp. 379–410, 13 figs., 20 refs. London, 1947.

The following is virtually the author's summary. Ticks owe their impermeability to water primarily to a superficial layer of wax in the epicuticle [*cf. R.A.E.*, B **36** 211]. After exposure to increasing temperatures, water loss increases abruptly at a certain "critical temperature". The critical temperature varies widely in different species; among 11 Ixodids it ranged from 32°C. [89·6°F.] in *Ixodes ricinus*, L., to 45°C. [113°F.] in *Hyalomma savignyi*, Gerv., and among five Argasids from 63°C. [145·4°F.] in *Ornithodoros moubata*, Murr., to 75°C. [167°F.] in *O. savignyi*, Aud. Species having higher critical temperatures are more resistant to desiccation at temperatures within the biological range. A broad correlation is possible between these powers of resistance and the natural choice of habitat. Argasids infest dry dusty situations, whereas Ixodids occupy a much wider variety of "ecological niches".

If the tick cuticle is rubbed with abrasive dust, evaporation is enormously increased. Living ticks partly restore their impermeability in moist air by secreting wax from the pore canals on to the surface of the damaged cuticle. Unfed ticks are able to take up water rapidly through the wax layer when exposed to high humidities. Water uptake, which is dependent on the secretory activities of the epidermal cells, is completely inhibited by the abrasion of only part of the total cuticle surface, and this suggests that the cells are functionally interconnected. Resistance to desiccation at low humidities is achieved by a dual mechanism: active secretion and the physical retention of water by the wax layer.

In Argasids, the epicuticle consists of four layers: the cuticulin, polyphenol, wax and outer cement layers. Only the three inner layers are present in Ixodids. Since the wax layer is freely exposed in the latter group, chloroform and detergents have a marked action in increasing transpiration, particularly in those species with low critical temperatures. In Argasids, the cement layer is very resistant to extraction, but is broken down by boiling chloroform. The cuticulin, polyphenol and wax layers are all secreted by the epidermal cells. The waterproofing layer, which is deposited on the completed polyphenol layer, is secreted by the moulting tick relatively early in development and may be nearly complete by the time moulting fluid is abundant. In *O. moubata*, the cement is poured out by the dermal glands shortly after emergence. In Ixodids, the dermal glands undergo a complex cycle of growth and degeneration, but their products appear to add nothing of functional significance to the substance of the cuticle.

PAPERS NOTICED BY TITLE ONLY.

SMITH (R. F.), HOSKINS (W. M.) & FULLMER (O. H.). **Secretion of DDT in Milk of Dairy Cows fed low-residue Alfalfa Hay.**—*J. econ. Ent.* **41** no. 5 pp. 759–763, 2 figs., 24 refs. Menasha, Wis., 1948. [See *R.A.E.*, A **38** 21].

COOLEY (R. A.). **The Genera** *Boophilus*, *Rhipicephalus*, **and** *Haemaphysalis* **(Ixodidae) of the New World** [including *H. juxtakochi*, sp. n., from deer in Panama].—*Bull. nat. Inst. Hlth* no. 187, iii+54 pp., 13 figs., 3½ pp. refs. Washington, D.C., 1946.

RIVERO (M. D.). **La infección experimental por el** *Haemoproteus columbae* **Celli y Sanfelice.** [Experimental Infection with *H. columbae.*]—*Medicina* **27** no. 531 pp. 197–204, 9 figs., 4 refs. Mexico, D.F., 1947.

Haemoproteus columbae, the organism of pigeon malaria, has proved suitable for testing the action of anti-malarial drugs, but experimental infection with it is difficult to obtain since the vector, *Pseudolynchia* [*canariensis*, Macq. (*maura*, Big.)], does not readily bite adult pigeons. If the development of the parasite in the intermediate host is that envisaged by Aragão, who considered that it terminated with the production of a reduced oökinete and that this is the form introduced into the pigeon by the bite of the Hippoboscid, it is possible that it might be completed in other blood-sucking insects, but if it proceeds according to the view of Adie, who stated that the oökinete becomes encysted and transforms to an oöcyst on the stomach of the fly and the resultant sporozoites migrate to the salivary glands of the fly and thence enter the pigeon [*R.A.E.*, B **12** 170], it is unlikely that another insect could serve as the intermediate host.

In order to test the possibility of another vector, the author carried out experiments with *Triatoma rubida*, Uhl., which was considered suitable because it digests its blood-meal very slowly and retains the coagulated blood of the host in its mid-gut for several months. Infected pigeons of which the blood showed numerous gametocytes that had reached the mature or extra-erythrocytic phase were chosen, and the development of the parasites in blood drawn from them and mixed with saline on a slide was observed. Numerous intraerythrocytic gametocytes abandoned the blood corpuscles and, together with the extracellular forms, assumed a spherical shape. The male gametocytes exflagellated after a few seconds and the resulting microgametes fertilised the macrogametes. Intraerythrocytic fertilisation occurred in some cases. Some 5–12 minutes after the extraction of the blood, the remaining free microgametes began to lose their mobility. Young nymphs of *T. rubida* were allowed to engorge on the birds of which the blood was thus shown to contain gametocytes in a suitable stage of maturity. After periods ranging from five minutes to six days, the bugs were killed, and the blood was extracted from their stomachs and examined. Blood extracted within the first few minutes after the meal showed the same process of parasite development as that taken directly from the pigeons. The first phases of the oökinete were observed 2–4 hours after the meal, and in addition to early oökinete forms, the mutilated forms that Aragão considered as the infective ones were present 24 hours after it. The appearance was much the same 48 hours after the meal, though digestion was further advanced, but degeneration of the oökinetes had set in at 72 hours and none remained at the later examinations.

To ascertain whether the oökinetes were the infective stages, blood extracted from the bugs 24, 48 or 72 hours after a meal on an infected pigeon was mixed with saline and injected after 24 hours endovenously into healthy birds. Small gametocytes were observed in the circulating blood of the latter 12–20 days later ; their development was followed for two months, and adult forms were observed. The parasite had thus reached the infective stage in *T. rubida.*

VON SCHMIDT (H.). **Durch Insekten hervorgerufene Krankheiten. Ihre Hygiene und Klinik.** [Diseases caused by Insects. Their hygienic and clinical Aspects.]—9½×6½ ins., [8+] 277 pp., 123 figs., 7½ pp. refs. Stuttgart, F. Enke Verlag, 1949. Price, unbound, D.M.30, bound, D.M. 32.50.

The subject of this book is the various ways in which insects and other Arthropods cause discomfort or transmit pathogenic organisms to man throughout the world. It is arranged in a series of chapters dealing with urticating hairs, glandular secretions, cantharidin, bites and stings, Arthropod vectors of diseases (to which the greatest amount of space is given), Arthropod parasites of man, species that may occasionally prove harmful as mechanical carriers of disease organisms, and general methods of control. It is written as much from the medical as from the entomological point of view, and treatments or remedies are indicated in most cases. Some information is given on the morphology, bionomics and distribution of the Arthropods.

LIU (Wei-T'ung). **Isolation of Typhus Rickettsiae from Rat Mites,** *Liponyssus bacoti,* **in Peiping.**—*Amer. J. Hyg.* **45** no. 1 pp. 58–66, 4 figs., 20 refs. Lancaster, Pa., 1947.

During an epidemic of typhus in a poorhouse in Peking in 1941, strains of typhus rickettsiae were recovered from examples of *Mus* (*Rattus*) *norvegicus* and of *Xenopsylla cheopis*, Roths., *Ceratophyllus anisus*, Roths., and *Liponyssus bacoti*, Hirst, taken on this rat in the poorhouse [*cf. R.A.E.*, B **30** 48; **37** 13]. Details are given of the isolation of strains from the mites. Little is known as to whether rat mites play a part in the transmission of typhus. The literature on this subject is briefly reviewed. The present study indicates that *L. bacoti* may carry the rickettsiae in nature and, in view of its feeding habits [**19** 178], may play an ancillary part in the transmission of typhus from rat to rat and from rat to man [*cf.* **20** 49].

HOVANITZ (W.). **Physiological Factors which influence the Infection of** *Aedes aegypti* **with** *Plasmodium gallinaceum.*—*Amer. J. Hyg.* **45** no. 1 pp. 67–81, 1 fig., 13 refs. Lancaster, Pa., 1947.

The following is substantially the author's summary. An effort was made to determine the physiological factors that influence the infection of *Aëdes aegypti*, L., with *Plasmodium gallinaceum.* No genetic effects on infectibility in *A. aegypti* were seen in six generations of selection [*cf. R.A.E.*, B **23** 284; **32** 92, etc.]. No parent-offspring correlations were found. It is possible that the colony of mosquitos used was homogeneous with respect to this condition and, therefore, not capable of genetic change.

There appeared to be some relation between the amount of blood ingested by the mosquito and the number of cysts that it develops, especially when the weight of blood ingested was considered in relation to the body weight of the mosquito. Mosquitos ingesting more than their own weight in blood have more cysts per female than those ingesting less than their own weight in blood. Mosquitos that develop more cysts as a group also lay more eggs. The mean number of cysts per female increases as the number of eggs increases. This is possibly an indication of a difference in the absorption of the blood after digestion, as the number of eggs laid is probably indicative of the amount of food materials available for their production. There is no correlation between the body weight of the mosquitos and their infectibility.

Physiological factors involved in the infection of mosquitos with malaria are of two sorts, hereditary and environmental. The former type is illustrated by specificity of species of *Plasmodium* to certain species of mosquito and perhaps also to certain strains, as described by Huff for parasites of avian malaria in *Culex pipiens*, L., and *C. fatigans*, Wied. (*quinquefasciatus*, auct.) [**23** 284, etc.]. The environmental nature of variability is illustrated by the quantitative variation of the individuals in inbred lots of *A. aegypti.*

GALVEZ GOMEZ (A.). **El mosquito, agente trasmisor de la poliomielitis.** [Mosquitos as Vectors of Poliomyelitis.]—*Medicina* **27** no. 537 pp. 351–357. Mexico, D.F., 1947.

The author reviews evidence indicating that poliomyelitis is not spread by contagion and suggesting that it may be transmitted by mosquitos. The spread of mosquito-borne diseases is limited by the distribution of their vectors, and the area of distribution of poliomyelitis in the United States is apparently the same as that of equine encephalomyelitis, which is sometimes almost indistinguishable from it in man and of which mosquitos are the principal vectors. It was observed during an outbreak of poliomyelitis that began in April 1946 in and near Havana, Cuba, that almost all the cases occurred in the proximity of breeding places of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.). The breeding places were kept free from mosquito larvae from the end of May, and the number of cases in the city declined from 30 in that month to 23 in June, 15 in July and 9 in August. No previous outbreak there had collapsed so rapidly.

Corrêa (R. R.) & Cerqueira (F. M. C.). **Descrição de** *Anopheles* (*Kerteszia*) *laneanus*, **nova espécie de anofelino de Campos do Jordão (Diptera, Culicidae).** [Description of *A. laneanus*, a new Species of Anopheline from Campos do Jordão.]—*Arq. Hig. Saúde públ.* **9** no. 20 pp. 111–117, 7 figs., 7 refs. São Paulo, 1944. (With a Summary in English.)

Corrêa (R. R.). **Do ciclo evolutivo em condições experiméntais do** *Anopheles* (*Kerteszia*) *laneanus* **(Diptera, Culicidae).** [The Cycle of Development of *A. laneanus* under experimental Conditions.]—*Op. cit.* **11** no. 30 pp. 605–611, 6 figs., 6 refs. 1946. (With a Summary in English.)

It is stated in the first of these papers that the male terminalia of *Anopheles* (*Kerteszia*) *cruzi*, D. & K., from its type locality in Rio de Janeiro were examined for the first time in 1943 by J. O. Coutinho and found to differ from published descriptions based on material from other localities. Males from the Serra do Mar and the coastal plain of São Paulo and Paraná resembled those from Rio de Janeiro, but a male from Campos do Jordão, in the Serra da Mantiqueira, São Paulo, had terminalia that differed somewhat and closely resembled those described by Komp for *A. cruzi* [*R.A.E.*, B **26** 18]. It is here described as *A.* (*K.*) *laneanus*, sp. n., and characters of the terminalia are given distinguishing it from *A. cruzi*.

In the second paper, the results recorded by various workers who have reared *Anopheles* spp. in the laboratory in Brazil are summarised, and an account is given of those obtained by the author with *A. laneanus*, which is a mountain species breeding in bromeliads of the genera *Aechmea* and *Canistrum* on *Araucaria* sp. Females taken in the type locality were allowed to oviposit on moist cotton and filter paper in tubes, and the eggs were transferred to tap water (slightly alkaline) in earthenware dishes. Crushed dried lettuce leaves were provided as food for the larvae, and the temperature was 15–28°C. [59–82·4°F.], with an average of 22·57°C. [72·6°F.]. The egg, larval and pupal stages lasted 5, 44 and 7 days, respectively, as compared with 4, 22 and 2 for *A. cruzi* under the same conditions. The differences in the male terminalia of the two species were confirmed ; the eggs were very similar.

Bates (M.). **The Natural History of Mosquitoes.**—$8\frac{1}{2}\times5\frac{1}{2}$ ins., xv+379 pp., 16 pls., 9 figs., 46 pp. refs. New York, N.Y. & London, Macmillan & Co., 1949. Price 25*s*.

The author's aim in writing this book was to collate the abundant and scattered published information on the behaviour of one family of insects in such a way as to present the knowledge acquired as an integrated whole, thus greatly increasing its usefulness and showing the aspects of the subject requiring further study. Mosquitos were a particularly suitable group for such treatment, not only because of the value of the resulting book to economic entomologists and public health workers but because their morphology and taxonomy have been studied more thoroughly than those of almost any other family.

First considering the development of the mosquito, stage by stage, the author reviews the flight, sexual and feeding habits of the adults, and their habitats, resting places, activity rhythms, orientation reactions and survival, egg production and oviposition, the structure, development and hatching of the eggs, larval habitats and the physical, chemical and biological aspects of the larval environment, the feeding, growth and behaviour of the larvae, and the behaviour of the pupae. A chapter follows on mosquitos in relation to other organisms (their hosts, the predators and parasites that attack them, and the organisms of which they are vectors). Separate chapters are accorded to consideration of the part they play as vectors of the malaria parasites and of viruses, and a full review is included of the viruses that attack mammals and are known to have mosquito vectors.

The final chapters are devoted to the problem of the definition and formation of species, the classification of mosquitos, which is used as a basis for a consideration of the general principles of animal classification, the distribution of mosquitos, field and laboratory techniques and the strategy of mosquito research. A systematic list of the mosquitos mentioned in the text, showing their general distribution, is appended.

MILNE (J. J. C.). **Malaria Control in Kuala Lumpur, Federated Malay States.**—*Med. J. Malaya* **1** no. 3 pp. 140–156, 27 refs. Singapore, 1947.

The history of malaria and its control in Kuala Lumpur between 1890 and 1941 is summarised. The disease increased in the early years, largely owing to clearing of valleys without adequate draining, but nevertheless the incidence has been low in relation to the population of the town. Outbreaks are stated to have occurred in 1930 and 1937–38. Lists are given of the Anophelines found in Kuala Lumpur, showing their usual breeding places in that locality and their importance as vectors of malaria as recorded in the literature. The commonest vector is *Anopheles maculatus*, Theo., though the outbreak in 1930 was associated with *A. hyrcanus* var. *nigerrimus*, Giles, and *A. h. sinensis* Wied. [*R.A.E.*, B **20** 276 ; **21** 192]. The methods used to control Anophelines are discussed.

NAIR (C. P.). **Habits of Adult Anopheline Mosquitoes of Malaya.**—*Med. J. Malaya* **1** no. 3 pp. 166–172. Singapore, 1947.

A list is given of the 14 species of *Anopheles* taken during the night between November 1945 and June 1946 in the neighbourhood of Klang, Malaya, by an anti-malaria unit, showing their relative abundance in human dwellings and cattle sheds and at different hours. The total number taken was 8,985, of which 3,912 were in dwellings and 5,073 in cattle sheds. Those taken in dwellings included 1,408 examples of *A. vagus*, Dön., 638 of *A. kochi*, Dön., 539 of *A. separatus*, Leic., 438 of *A. hyrcanus* var. *sinensis*, Wied., 343 of *A. letifer*, Sandosham, and 342 of *A. barbirostris*, Wulp, and these numbers represented 28·4, 41·6, 96, 49·8, 94, and 70 per cent. of the total catches of the respective species.

ABRAHAM (O. K.). *Anopheles* (*Anopheles*) *kyondawensis* **n. sp., from Lower Burma.**—*Med. J. Malaya* **1** no. 3 pp. 173–176, 5 figs., 3 refs. Singapore, 1947.

Anopheles kyondawensis, sp. n., is described from larvae collected in 1943 from small, shallow pools of clear water, under shade, by streams in hilly jungle at Kyondaw, Lower Burma.

de Fluiter (H. J.). **Malaria en malaria-overbrengers in de krijgsgevangenkampen Chungkai en Tamuang (W. Thailand).** [Malaria and Malaria Vectors in the Chungkai and Tamuang Prisoner-of-war Camps (West Siam).]—*Ent. Ber.* **12** no. 283 pp. 270–275, 3 refs. Amsterdam, 1948. (With a Summary in English.)

The author gives the results of blood tests for malaria parasites carried out in 1944 and 1945 on the population of two hospital camps for prisoners of war on the river Mekong, in the west of Siam, and a list of 20 species of *Anopheles* recorded from that country. Anopheline breeding places were numerous in and round the camps, and the species taken in them were *A. vagus*, Dön., and *A. kochi*, Dön., in stagnant water and rice-fields, *A. tessellatus*, Theo., in an overgrown pool, *A. philippinensis*, Ludl., in rice-fields, ditches and excavations, *A. barbirostris*, Wulp, in ditches after one of the camps had been flooded by the river, *A. minimus*, Theo., in a ditch, and *A. culicifacies*, Giles, in ditches and rice-fields. Larvae of *A. vagus* were very numerous, those of *A. kochi* somewhat less so, and the other species scarce. Adults of *A. vagus* and *A. philippinensis* were attracted to man in trapping experiments, and engorged females of *A. barbirostris* were taken in huts. The species that appeared from the literature likely to act as vectors of malaria were *A. barbirostris*, *A. minimus* and *A. culicifacies*, but although many of the persons in the camps were found to be infected, no fresh cases occurred.

Jerace (F.). **Ricerche sperimentali sull'azione delle onde corte sul ciclo biologico delle zanzare.** [Experimental Researches on the Action of Short Waves on the biological Cycle of Mosquitos.]—*Riv. Malariol.* **27** no. 2 pp. 53–73, 17 refs. Rome, 1947. (With a Summary in English.)

In the experiments recorded in this paper, adults of *Culex pipiens*, L., and separate lots of eggs, larvae, pupae and adults and the successive stages of a complete generation of *Anopheles maculipennis*, Mg., were subjected to short-wave irradiation (wave-length 6 metres) by a technique and from an apparatus described in detail. Effects of heat were eliminated. There were no effects on the duration of development or mortality as compared with the controls.

Ferraro (F.). **Variazioni anofeliche nel Bacino del Basso Volturno.** [Variations in the Anophelines of the Basin of the Lower Volturno.]—*Riv. Malariol.* **27** no. 2 pp. 74–79, 12 refs. Rome, 1947. (With a Summary in English.)

Investigations between 1935 and 1940 into the Anopheline fauna of the basin (north side) of the lower Volturno, which had been extensively reclaimed, showed that *Anopheles maculipennis*, Mg., vars. *typicus*, *labranchiae*, Flni., *melanoon*, Hackett, and *messeae*, Flni., predominated, with some admixture of *A. claviger*, Mg. (*bifurcatus*, auct.), while *A. maculipennis* var. *sacharovi*, Favr (var. *elutus*, Edw.) was also present on the southern side of the river. After the military operations of 1943, however, in which the reclamation works were destroyed and the area devastated, var. *sacharovi* spread to the northern side, where it was common in 1945. It is known to breed preferably in water of high salinity (six parts sodium chloride per mille according to Papadakis [*R.A.E.*, B **25** 146]), but the salinity of the water at 14 localities in the area was found to range only from 0·58 to 4·09 parts per mille. Of 276 females of *A. maculipennis* taken at these places, 181, 42, 18, 13 and 22 were shown by the characters of the eggs they laid to belong to vars. *labranchiae*, *sacharovi*, *melanoon*, *messeae* and *typicus*, respectively. It is concluded that the reason for the spread of var. *sacharovi* must be sought in the devastation of the area, involving the abandonment of cultivation, the dispersion of cattle and the formation of swamps.

CHWATT (L. J.). *Aedes* (*Stegomyia*) *pseudoafricanus* **sp. nov.: a new Species of** *Aedes* **from the Coast of Nigeria (British West Africa).**—*Nature* **163** no. 4151 pp. 808–809, 5 refs. London, 1949.

Characters are described distinguishing adults of both sexes of *Aëdes* (*Stegomyia*) *pseudoafricanus*, sp. n., reared from larvae found in rain water in holes in white mangrove trees (*Avicennia nitida*) growing in the spring-tide zone of salt-water swamps near Lagos, Nigeria, from those of *A.* (*S.*) *africanus*, Theo., a common tree-hole breeder in the area [*R.A.E.*, B **14** 219; **16** 92]. The two species had previously been confused; the principal difference is in the structure of the male terminalia. The new species is known at the present time only from the open salt-water swamps with wide stretches of *Paspalum* grass, coarse fern and clumps of low *Avicennia* trees. Preliminary catches suggest that it is predominantly crepuscular and not as strictly arboreal as *A. africanus* [*cf. R.A.E.*, B **37** 177]. It has been reared to the third generation in the laboratory. In a preliminary experiment in which a female was fed on a rhesus monkey [*Macaca mulatta*] previously inoculated with yellow-fever virus and was ground and injected into white mice 11 days later, the mice developed the disease and died of it.

HADAWAY (A. B.) & BARLOW (F.). **Further Studies on the Loss of Insecticides by Absorption into Mud and Vegetation.**—*Bull. ent. Res.* **40** pt. 3 pp. 323–343, 8 refs. London, 1949.

An account is given of further tests in Uganda, more detailed than those already noticed [*R.A.E.*, B **36** 19], on the effectiveness of DDT when applied in various formulations on an absorptive dried mud surface and on leaves and of a deposit of BHC (benzene hexachloride) on the former. The following is based on the authors' summary. Formulations of DDT were applied to standard mud blocks, and toxicities to *Glossina palpalis*, R.-D., and *Aëdes aegypti*, L., and the proportions of insecticide recovered from an outer layer about 0·1 mm. thick were compared. Absorption of DDT in unemulsified oil solutions was considerable, and amounts recovered from the outer layer were only 8–19 per cent. of the total dosage applied. Adsorption of the insecticide from the oil on to mud occurred. There was some correlation between the capillary rise of the solvent and the extent of absorption. The addition of 5 per cent. DDT or BHC to the solvent reduced the rise slightly. Toxicities of the blocks treated with DDT to test insects were low. Mortality of *G. palpalis* after contact for 15 minutes varied from 5 to 40 per cent., and mortality of *A. aegypti* after contact for one hour was never more than 15 per cent.

Increasing the percentage of DDT in power kerosene from 2 to 5 and from 5 to 10 did not cause an increase in the proportion held on the surface. Application of excessively heavy dosages increased the amounts in the outer layers, but there was a trend towards greater absorption, and therefore to greater waste, at the high dosages. Repeated applications similarly built up a larger dosage in the outer layer but did not increase the proportion there. Emulsified solutions were intermediate between unemulsified solutions and wettable-powder suspensions as regards absorption and toxicity. Up to 77 per cent. of DDT applied as wettable powder was recovered from the outer layer, and toxicities were correspondingly high. There was 75–100 per cent. mortality of *G. palpalis* after contact for 15 seconds and 37–90 per cent. mortality of *A. aegypti* after contact for 30 minutes. BHC was tested only as a wettable powder and was rapidly lost from the surface by volatilisation. After 15 days the dosage had decreased considerably, the percentage in the outer layer had fallen from over 70 per cent. to 20 per cent., toxicity to *Aëdes* had been halved and toxicity to *Glossina* had been reduced still more.

Loss of DDT by penetration of the carrier oil through the leaf cuticle occurred when an oil solution was sprayed on vegetation (young coffee or avocado). The extent of penetration varied with different plants, even of the same species and age. There was an indication that small amounts of DDT were transferred from the inside of treated leaves to untreated parts of the plants. Deposits of DDT on leaves exposed to ordinary climatic conditions remained toxic to *G. palpalis* for longer when applied in an emulsified than in an unemulsified oil solution. Percentage kills in 24 hours after contact for 20 seconds with a deposit 3 or 24 hours or 1, 2, 3 or 5 weeks old were 100, 100, 15, 10, 15 and 0, respectively, in the case of an unemulsified solution and 80, 50, 75, 50, 40 and 15 in that of an emulsion. The emulsion still gave 15 per cent. kill after eight weeks. Deposits from a water suspension of a wettable powder were washed off readily by rain ; when rainfall was heavy, there was no kill of *G. palpalis* exposed for one minute 24 hours or more after treatment. There was some evidence that continuous exposure to sunlight produced some chemical change in deposits of DDT applied to glass plates as a solution in kerosene and reduced their toxicity.

MOGGRIDGE (J. Y.). **Observations on the Control of Kenya Coast** *Glossina*.—*Bull. ent. Res.* **40** pt. 3 pp. 345–349, 1 pl., 2 refs. London, 1949.

Fly rounds having shown that *Glossina pallidipes*, Aust., *G. brevipalpis*, Newst., and *G. austeni*, Newst., thrive where vegetation is densest, the possibility of effecting control by clearing was investigated in a small reclamation experiment begun in 1938. An area of 92·4 acres of thicket growing on coral rag rock on the Kenya coast was isolated during the dry season by barrier clearings 140 yards wide on the north and south and 200 yards wide on the west. The whole of the area to the east of the block had already been cleared to a distance of 1,100 yards. Close growing thicket, climbing plants and woody growth were cut out of the experimental block, but shrubs and trees were left untouched. Trash was piled, where possible over stumps, and burnt. Regenerated growth had to be cut back at the end of the wet season, but in practice, it would be kept in check by grazing. From January to March 1939 when the barriers were clear, the average catches per hour in the experimental block and (in brackets) a control block were 0·44 (32·6) for *G. pallidipes*, 0·4 (51·4) for *G. austeni* and 0 (2·8) for *G. brevipalpis*. In April–July (wet season), when the barriers were no longer clear, the figures were 10 (82), 0 (30) and 0 (0·71).

These results indicate that *G. austeni* and *G. brevipalpis* can be eliminated by the procedure described, and probably *G. pallidipes* also. It will probably be uneconomical to undercut large areas of homogeneous thicket or forest to provide grazing for stock, but the method may be of use where grazing land is unsafe for stock because of the presence of *Glossina* in clump thickets.

A Harris trap [*R.A.E.*, B **19** 78] and Swynnerton's SS trap [a plain screen trap with side awnings (**21** 114)] were tested in the course of the experiment under both wet-season and dry-season conditions and proved completely ineffective against both *G. pallidipes* and *G. austeni*.

KRIJGSMAN (B. J.) & BERGER (N. E.). **A simple Method for the Estimation of Contact Insecticides.**—*Bull. ent. Res.* **40** pt. 3 pp. 355–358, 1 fig., 8 refs. London, 1949.

In this paper, which is noticed more fully elsewhere [*R.A.E.*, A **38** 47], the authors describe a method of bioassay of the content of active material in preparations of certain contact insecticides. It consists of exposing adults of *Calandra granaria*, L., to deposits of the preparation and of the pure insecticide that it contains and comparing the median lethal deposits. The insecticides for which it has been found suitable are γ benzene hexachloride, DDT and chlordan (Velsicol 1068).

Ribbands (C. R.). **The Duration of the aquatic Stages of *Anopheles minimus*, Theo., determined by a new Method.**—*Bull. ent. Res.* **40** pt. 3 pp. 371–377, 4 figs., 5 refs. London, 1949.

A new method of determining the duration of the aquatic stages of Anophelines in nature is described. Daily dippings were made at intervals of one foot in a 100-ft. stretch of stream, and the numbers of pupae and of larvae of each instar at each dip were recorded. All larvae were returned to the stream. As fluctuations in numbers taken, due to variation in water level, were too great for the number of larvae per dip to be an accurate index of the population present, the catches of larvae of each instar and pupae were expressed as a percentage of the total catch of larvae and pupae for the day. The duration of the aquatic stages was determined by analysis of the sequence of peaks in these numbers.

The investigations were made in Assam in 1945 during the monsoon rains, when the average daily minimum and maximum water temperatures were 26·5°C. [79·7°F.] and 30·6°C. [87·08°F.]. Only larvae of the group *Myzomyia* were counted, and the estimated specific composition of the population based on the rearing of 71 individuals was 74 per cent. *Anopheles minimus*, Theo., 16 per cent. *A. varuna*, Iyen., and 10 per cent. *A. aconitus*, Dön. The average duration of the larval stage under the conditions of the study was found to be seven days. Scanty data on adult peaks indicated that the life-cycle probably lasted 14 days, composed of 2 days for the egg stage, 7 for the larval stage, 2 for the pupal stage and 3 for the period from adult emergence to the beginning of oviposition.

Jones (T. W. T.). **Experimental aerial Spraying with DDT against Mosquitos in Burma.**—*Bull. ent. Res.* **40** pt. 3 pp. 379–385, 1 pl., 1 map. London, 1949.

An account is given of an investigation on Akyab Island, Burma, into the effect of applying solutions containing 5 per cent. DDT as sprays from aircraft for the control of Anopheline larvae and adults. A rapid field method for estimating the amount of DDT deposited is described. The lake used for studies on larvae was open, with no high trees to impede the falling spray. The species found in it were *Anopheles jamesi*, Theo., *A. annularis*, Wulp, and *A. hyrcanus*, Pall. At 2–3 mg. DDT per sq. metre, the spray had little effect on larvae in water completely covered with a species of *Limnanthemum*, and tall grass and algae enabled about one-third of the larvae to survive, whereas complete kill was effected in open water. There was evidence that the treatment was not effective for more than six days.

The village where adult control was tried consisted partly of scattered huts in clearings of dense woodland and partly of a compact mass of recently built huts in the open. The only species of *Anopheles* found was *A. vagus*, Dön., which rests in huts by day but mostly out of doors at night. The wind was negligible, so that the spray fell vertically, and the amounts of DDT deposited on the ground were 2–3 mg. per sq. m. in the open, 0·5–0·7 mg. in partial shade and less than 0·05 mg. under dense shade. Thus, low shrubs in heavily wooded areas were considerably protected from the spray and provided almost safe resting places for adult Anophelines. Kill was complete in the open part of the village and considerable in the other part, the numbers of Anophelines taken in huts at night before spraying and on the first, second and fourth nights after it being 10, 0, 0 and 0 per hut in the open part and 22, 3, 4 and 4 in the other part. There was no penetration of DDT into huts, even when these were situated in the open.

MATTINGLY (P. F.). **Studies on West African Forest Mosquitos. Part II. The less commonly occurring Species.**—*Bull. ent. Res.* **40** pt. 3 pp. 387–402, 3 figs., 12 refs. London, 1949.

The following is based on the author's summary and discussion. This is the second of two papers dealing with studies on mosquitos in swamp forest near Lagos, Nigeria. Four of the most abundant species found were considered in the first paper [*R.A.E.*, B **37** 176], and this one is concerned with the remaining 48, a list of which is given. The data relating to the 38 least plentiful, with the exception of two of which males only were taken, are presented in tabular form. The other ten are dealt with at greater length. Males of 26 species were taken, and in the case of three, they were abundant enough to give the impression that a swarming activity was involved. Seasonal distribution curves, based on average monthly catches, are given for the ten more abundant species, and an attempt is made to relate these curves to variations in rainfall. The biting curves showed a greater variety of types than those described in the first paper. In general, they were characterised by a fairly sharp peak associated with dawn or dusk, but some had a more or less pronounced peak at both ends of the cycle and so correspond to Haddow's second (eo-crepuscular) type [**33** 190]. *Anopheles paludis*, Theo., like *Mansonia* (*Taeniorhynchus*) *africana*, Theo. [**37** 177], had an ill-defined period of maximum activity during the middle of the night. The necessity of sub-dividing the figures in order to obtain a picture of the vertical distribution of the various species led in one or two cases to anomalous results, but in general a clear and fairly convincing picture was obtained. None of the 48 species was abundant enough to provide reliable data on hourly variations in vertical distribution.

Attention is drawn to the fact that the so-called biting cycle probably does not depend exclusively on variations in the urge to bite. This is important since biting may well be affected by the difference between the skin temperature and humidity of the bait [*cf.* **37** 58] and the temperature and humidity of the surrounding atmosphere, but light, which appears to have an inhibitory influence, seems unlikely to affect biting except in so far as it affects the general level of activity of the mosquito. It is possible that intrinsic rhythms, affecting the mosquito independently of changes in its physical environment, may also be involved. Laboratory experience indicates that mosquitos feed most readily after a certain quite circumscribed period has elapsed since emergence [*cf.* **30** 87 ; **36** 184]. If this is true in nature, the biting cycle may be related to some extent to the breeding cycle and in particular to the time of emergence. The first ten catches in the present work were made at intervals of one week. The first was incomplete. The total number of *Aëdes africanus*, Theo., taken in each of the next seven, those in which this species was most abundant, followed very closely the proportion occurring on the top platform in the preceding week. The agreement appears to be explained in part by the presence of *A. pseudoafricanus*, Chwatt [**38** 22], a sibling species distinguishable only by the male terminalia and possibly small differences in the scutal markings. A single undissected male of *A. pseudoafricanus* was found in the author's collection, and there were several others from Yaba and Lagos in the British Museum collection labelled *A. africanus*. Preliminary observations suggest that it is more of a ground-biter than *A. africanus* and it may have a rather more diffuse type of biting cycle. This would explain discrepancies in the behaviour of *A. africanus* noted in the first paper. Whether it affords a complete explanation of the phenomena under discussion can be decided only when the biting cycle and vertical distribution of *A. pseudoafricanus* have been fully worked out. Some relationship between vertical distribution and the breeding cycle may also be involved.

KETTLE (D. S.). **The Speed of Action of insecticidal Sprays and Deposits and its Use in assessing the biological Efficiency of BHC, DDT and Pyrethrum.**—*Bull. ent. Res.* **40** pt. 3 pp. 403–429, 8 figs., 21 refs. London, 1949.

The following is mainly based on the author's summary. This paper is concerned with the standardisation of a technique for the estimation of the speed of action of insecticidal sprays and deposits on adults of *Musca domestica*, L., as indicated by their speed of knockdown, and with the application of this technique to the assessment of the biological efficiency of insecticidal solutions. Tests were made with sprays of BHC (benzene hexachloride), DDT and pyrethrum, and with DDT deposits.

The speeds of action of both sprays and deposits were greatly affected by the duration and intensity of illumination to which the flies were exposed before treatment and by the ratio of the sexes in the treated population. The first factor was eliminated by conditioning the flies to an intensity of illumination of 20 foot-candles overnight (for at least 17 hours), and the second was minimised by estimating the knockdown time for 50c per cent. instead of 50 per cent. of the flies, where $50c = 0{\cdot}67\,x + 0{\cdot}33\,y$ and x and y represent the percentages of males and females, respectively, in the treated population. This relationship appeared to be independent of the technique, as it was the same for 0·05 per cent. γ BHC in petroleum distillate used as a spray and for deposits of pure p,p′DDT put down from petroleum distillate. The experimental evidence on which this correction is founded is set out in full.

It was found that there was a separate straight-line relationship between the percentage knockdown in terms of probits and the time after spraying (or the time of exposure) in minutes for males and females of *M. domestica*. It follows that such a relationship is not true for a population of mixed sexes. The method of calculating the corrected median knockdown time (KD 50c) is given in detail.

The speeds of knockdown of solutions of pyrethrins, γ BHC and p,p′DDT were proportional to the concentration of the insecticide in the solution. This conclusion was applied to the estimation of γ BHC in solutions of unknown strength. In six instances in which the estimated and actual percentage concentrations were compared, the former were 0·194, 0·098, 0·062, 0·068, 0·134 and 0·060 and the latter 0·200, 0·100, 0·050, 0·100, 0·150 and 0·060, respectively. The mean percentage difference was 12. The method allows one man to estimate the γ content of three solutions in a day. It is thought that the greatest source of error lies in the inadequacy of the sex correction factor when applied to small samples. This can be eliminated by duplication of tests or by the use of one sex only. The latter method is considered preferable.

Experiments with DDT deposits on aluminium plates showed that the speed of action was independent of the deposit, providing that this was above 2 mg. p,p′DDT per sq. ft. However, when the deposit was applied on paper-covered panels, its speed of action varied with its magnitude [*cf. R.A.E.*, B **36** 17]. A deposit on aluminium from a solution of pure p,p′DDT acted more quickly than a deposit of the same amount of p,p′DDT from a solution of technical DDT (80 per cent. p,p′). A deposit had a more rapid action when it was in a form that could act both as a stomach and as a contact poison. Ball-milled technical DDT applied as a suspension acted more quickly than an equivalent deposit of technical DDT from petroleum distillate, because the crystals of the latter adhered too tightly to the aluminium for the flies to ingest them. Examination under the microscope of the deposit from the suspension showed that it was punctuated with small round clear areas of the size of the labella of a fly's proboscis. Crystalline deposits also showed proboscis marks, but there was no sign of any of the deposit having been removed.

JOHNSTON (A. N.). **Studies on the Action of DDT on Anopheline Mosquitos and House-flies.**—*Bull. ent. Res.* **40** pt. 3 pp. 447–452. London, 1949.

The studies recorded in this paper, which were made in Queensland, consisted of investigations on the toxicity of p,p′DDT dissolved in malariol, principally as a 4 per cent. solution, to larvae, pupae and adults of *Anopheles punctulatus*, Dön., and the toxicity of the residue from 4 per cent. p,p′DDT in kerosene to *Musca domestica*, L. The mortality rate of Anopheline larvae appeared to depend on the period of exposure to the film of oil and DDT. Exposures of fourth-instar larvae for 1, 5, 15 and 30 seconds and 1, 5 and 15 minutes to DDT solution at 2 quarts per acre caused 35, 60, 40, 20, 60, 85 and 100 per cent. mortality in 24 hours, respectively. Some additional individuals that pupated died on emergence. No significant difference between the reaction of different larval instars was apparent. Pupae seemed to be more sensitive to DDT than is generally believed. Complete mortality was obtained when pupae of *A. punctulatus* were exposed to 1 pint or 2 pints per acre of 5 per cent. DDT for 25 minutes or continuously and pupae of *Aëdes vigilax*, Skuse, continuously to a dosage of 2 pints, but often, particularly in the case of the restricted exposure, death did not occur until emergence. This was not due to action of residue on the adult as the pupae had been removed from the treated water and washed twice.

Of 31 adults of *Anopheles punctulatus* confined in small tubes with strips of plywood treated with DDT at 100 mg. per sq. ft., two, 18 and all were dead in ¾, 1¾ and 2½ hours, and only one was not down in ¾ hour. When the mosquitos were kept in tubes lined with leaves treated at 100 mg. per sq. ft., 14 out of 17 were down after 1¼ hours, all were down or dead after 2¼ hours and all were dead after 2¾ hours. No difference was noted between smooth and hairy leaves treated at the same rate (50 mg. per sq. ft.). When exposure was restricted, one, one, four and five mosquitos out of six were dead in six hours after exposure for ½, 1, 5 and 15 minutes, respectively; with an exposure of 30 minutes, four were dead and two down. With the two longest exposures, five were down in two hours. In a field trial in which an area of open scrub was treated with 6 gals. spray (2,724 gm. DDT) per acre, populations of *A. farauti*, Lav., and *Aëdes vigilax* fell immediately, but whereas the latter remained scarce until 38 days after spraying, 25–50 per cent. of the drop in the population of the former had been made good after nine days.

When adults of *M. domestica* were confined with strips of plywood treated at 100 mg. DDT per sq. ft., the percentages dead in 2½ hours were 63, 84, 82 and 100 after exposure for 5, 30, 60 and 300 seconds, respectively. There was complete mortality among flies confined in tubes in which treated individuals previously exposed for 10 minutes to a lethal deposit had been kept for two hours.

HEATH (G. D.). **An improved Method for the Generation of insecticidal Smokes.**—*J. Soc. chem. Ind.* **68** pp. 41–44, 1 fig., 2 refs. London, 1949.

A detailed account is given of the work leading to the adoption of an improved pyrotechnic composition for the generation of insecticidal smokes. The mixtures previously devised [*R.A.E.*, B **37** 227] had to contain much more sugar than could be oxidised to carbon dioxide and water by the potassium chlorate, and the pyrolysis of this excess of sugar leads to the formation of formaldehyde and other combustible products, the presence of which renders the smoke liable to ignite on issuing unless it is cooled by a baffle before being discharged into the air. A fuel that would give rise to incombustible products and so render a baffle unnecessary was therefore sought. The improved formula comprises 12 per cent. thiourea, 7·3 per cent. urea, 25·8 per cent. potassium chlorate, and 54·9 per cent. DDT, and its chemical efficiency [*cf. loc. cit.*] was approximately 90 per cent., which is considered to be about the maximum obtainable with DDT. It burned without a flame even when it was placed loosely in an open tin and heated to a temperature of 50–55°C. before being ignited. Its ignition temperature is 145°C., but it is liable to ignite if heated for long periods at lower temperatures. In tests, it ignited in 15½ minutes at 129°C., and in 48 minutes at 115°C.; at 111°C., it had not ignited in 24 hours.

When 54·9 per cent. BHC (benzene hexachloride) was substituted for the DDT in the mixture, its chemical efficiency was 89·5 per cent. This figure could probably be exceeded by varying the proportions of the constituents, since BHC is more stable to heat than DDT.

VELBINGER (H. H.). **Wirkung und Anwendung des Phenothiazins als Antiparasiticum. Neue Untersuchungen zur Feststellung der vermiziden und insektiziden Wirksamkeit.** [Action and Application of Phenothiazine as an Antiparasitic. New Investigations on its vermicidal and insecticidal Effect.]—*Dtsch. tierärztl. Wschr.* **54** no. 17–18 pp. 130–133, 5 refs. Hanover, 1947.

The author discusses the toxicity of phenothiazine to insects and parasitic worms and reviews the results of some of his own experiments with insects in Germany, from which he concludes that it acts as a cerebrospinal contact poison and has about the same range of effectiveness as rotenone. It is more toxic to many insects than rotenone, but less so than DDT. In dusts or washes, it gave high mortality of *Pediculus humanus capitis*, Deg., on man, *Haematopinus asini*, L., on horses, *Docophorus* sp. on fowls, and *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., on dogs. It was less effective as a dust against *Musca domestica*, L., and ineffective against *Cimex lectularius*, L.

[ZIMIN (L. S.).] **Зимин (Л. С.). Key to the third-instar Larvae of the Synanthropic Flies of Tadzhikistan.** [*In Russian.*]—*Opred. Faune SSSR* no. 28, 115 pp., 61 figs., 31 refs. Moscow, Izd. Zool. Inst. Akad. Nauk SSSR, 1948. Price 9 *rub.*

Keys are given to the larvae of the flies associated with man in Tadzhikistan [*cf. R.A.E.*, B **31** 26, 126; **34** 110], followed by descriptions of them and notes on their breeding places. They include members of 12 families, but the great majority are Muscids, Calliphorids and Sarcophagids.

SCHROEDER (H. O.), JONES (H. A.) & LINDQUIST (A. W.). **Certain Compounds containing the Methylenedioxyphenyl Group as Synergists for Pyrethrum to control Flies and Mosquitoes.**—*J. econ. Ent.* **41** no. 6 pp. 890–894, 7 refs. Menasha, Wis., 1948.

The following is virtually the authors' summary. Thirty compounds containing the methylenedioxyphenyl group [*cf. R.A.E.*, B **37** 159, etc.] were tested as synergists for pyrethrum. The tests were made in small chambers (100 cu. ft.) and also in large rooms (7,000 cu. ft.). The materials were tested first at a 10 per cent. concentration in a solution containing 1 per cent. DDT and 0·1 per cent. pyrethrins in cyclohexanone. The more effective compounds were also tested in this solution at concentrations of 5 and 1 per cent. Solutions containing 2 per cent. pyrethrins and 20 per cent. of the synergists (without DDT) were used in the room tests. At the 10 per cent. concentration, 20 compounds greatly increased the knockdown and mortality of *Anopheles quadrimaculatus*, Say. Only about half as many were effective against *Musca domestica*, L. The effect on the house-flies was greater in knockdown than in mortality. Ten of the compounds had no significant effect on either test insect. Materials effective against both flies and mosquitos were piperonyl cyclonene [formerly designated piperonyl cyclohexenone (*cf.* **37** 116)], 4-(3,4-methylenedioxyphenyl)-5-methyl-1, 3-dioxane, 2-(3, 4-methylenedioxyphenyl)-4,4-diethyl-1, 3-dioxane, sesamin concentrate, and the n-amyl ester of piperonylic acid. Additional compounds especially effective against mosquitos were a number of other esters of piperonylic acid, the di-n-butyl ester of piperonylidenemalonic acid, and 1-(3,4-methylenedioxyphenyl)-l-acetoxybutene-3.

Madden (A. H.) & Lindquist (A. W.). **Improvement of Nozzles for applying concentrated Insecticides as fine-mist Sprays.**—*J. econ. Ent.* **41** no. 6 pp. 919–924, 2 figs., 3 refs. Menasha, Wis., 1948.

As capillary-tube sprayers have proved of value for applying concentrated sprays to control household insects [*cf. R.A.E.*, B **34** 168; **37** 101], tests were carried out to obtain information of use in the improvement of nozzles for applying these insecticides as fine-mist sprays against mosquitos and house-flies (*Musca domestica*, L.). The mosquito used was *Anopheles quadrimaculatus*, Say, and the test spray contained 20 per cent. DDT, 15 per cent. of a 20 per cent. pyrethrum extract (giving 3 per cent. pyrethrins), 20 per cent. piperonyl cyclonene, 20 per cent. cyclohexanone and 25 per cent. kerosene. The following is based on the authors' summary of the results. The data indicate that the best results against both insects are obtained with a nozzle having a capillary tube with an internal diameter between 0·015 and 0·025 inch. An air vent 0·04 inch in diameter was generally used; when one with a diameter of 0·03 inch was substituted, results were inferior. In general, replacing the low-viscosity solvents (cyclohexanone and kerosene) by one of high viscosity (benzyl benzoate) made no difference in effectiveness. The number of particles decreased more than their size as the time that had elapsed since spraying increased. Under the conditions of the tests, the size and number of particles in the mist were more important in the control of flies than in that of mosquitos as the effective dosage against mosquitos is lower. Apparently house-flies need a narrower range of particle size than mosquitos, although under practical conditions, longer exposures might tend to equalise this factor.

Cross (H. F.) & Snyder (F. M.). **Field Tests of Uniforms impregnated with Mite Toxicants: I. Protection Studies.**—*J. econ. Ent.* **41** no. 6 pp. 936–940, 6 refs. Menasha, Wis., 1948.

Snyder (F. M.) & Cross (H. F.). **Part II. Stopping-time Studies.**—*T.c.* pp. 940–941, 4 refs.

In a search for chemicals more resistant to washing than benzyl benzoate, the material adopted by the United States Army for impregnating uniforms to prevent attachment by Trombiculid vectors of tsutsugamushi disease [*cf. R.A.E.*, B **35** 191], 18 out of 6,000 materials tested against Trombiculids in Florida were outstanding. Data obtained during the summer of 1946 on their effectiveness in giving protection to wearers of impregnated cotton herringbone uniforms and woollen socks are discussed in the first part of this paper. About 2 gm. material (applied in acetone) was used per sq. ft. of cloth. In the first field trial, in which clothing was tested after the second and subsequent washings, diphenyl carbonate and 2-thenyl salicylate gave complete protection after all washings up to the eighth and seventh, respectively, benzil [*cf. loc. cit.*] and p-cresyl benzoate gave complete protection only until after the fourth washing, but 95 per cent. protection or almost after all washings up to ten [*cf.* **38** 1], and 2-thenyl benzoate gave 98–100 per cent. protection after all washings up to the seventh. These were the most promising materials. Benzyl benzoate gave complete protection after three washings but was ineffective after four. Some materials that gave good protection were discarded because of undesirable properties. Apart from p-cresyl benzoate, which was inadvertently omitted, the best materials were retested after two, three, six and more washings in a second series of field trials. The others gave protection similar to that given in the first series. Phenyl benzoate, included because of its possible interest to those working with repellents, gave 100, 100, 97·9 and 0 per cent. protection after six, seven, eight and nine washings. After weathering out of doors with exposure to rain, diphenyl carbonate gave complete protection for 54 days but was not effective after 66 days ; 2-thenyl salicylate gave complete protection for 39 days and 95 per cent. protection after 90 days and one washing ; 2-thenyl benzoate gave complete protection for 39 days, allowed a few attachments after 47 days and then gave complete protection until after 77 days, but none after 90 days and one washing ; p-cresyl benzoate gave complete protection for 39 days but none after 60 days ; benzil gave complete protection for 33 days and 94 per cent. protection after 90 days and one washing ; phenyl benzoate afforded complete protection for only 24 days and no protection after 47 days ; and benzyl benzoate was ineffective after 21 days.

In the second part of the paper, the relation between protection and stopping time (the time needed to immobilise the mites) is examined. Stopping time is commonly used in the evaluation of compounds as Trombiculid poisons, and a stopping time of 15 minutes had been arbitrarily chosen as the basis for eliminating ineffective materials. To estimate the validity of this choice, tests of stopping time were made on small squares of material cut from the uniforms used in the protection tests and submitted to the same washing. For all materials, the intervals between the time when the mites were first affected and the time when they were immobilised increased with the number of washings, but the rate of increase varied with different chemicals. The records from all tests are summarised in a table. In the 74 tests in which protection after the second and third washing was 95–100 per cent., 63·5, 20·3 and 16·2 per cent. of the tests had stopping times of less than 15 minutes, 16–30 minutes and 31 minutes or more, respectively. In the 18 in which less than 80 per cent. protection was given, 11·1, 22·2 and 66·6 per cent. had stopping times of less than 15 minutes, 16–30 minutes and 31 minutes or more. Data given in the first part of the paper show that in 12 of 16 tests, stopping times after the last washing followed by complete protection were 15 minutes or less, but after the next washing, stopping times were below 15 minutes in only four of the 16 tests. It is concluded that some correlation exists between stopping times and protection but that no definite limit of time can be set for all materials on the basis of these tests. If stopping times are 15 minutes or less, protection of 90 per cent. or more may be expected, but when stopping times are greater than 15 minutes, protection may range from 0 to 100 per cent.

Abdel-Malek (A.). **The Biology of** *Aëdes trivittatus*.—*J. econ. Ent.* **41** no. 6 pp. 951–954, 2 figs., 2 refs. Menasha, Wis., 1948.

Field and laboratory observations on the bionomics of *Aëdes trivittatus*, Coq., a troublesome mosquito widely distributed in southern Canada and the eastern United States, were made in Ohio in 1946 and 1947. The species overwinters in the egg stage, and larvae were found in the second half of June 1947 in temporary rain or flood pools with considerable vegetation in open positions in swamp forest. The minimum period from hatching to adult emergence was apparently eight days, as compared with a range of 6–10 days in the laboratory at a rather higher temperature. Adults were present in the field from the first week of June until September, males emerging first and living only a few days. Females were most active at dusk, but would bite even in bright sunlight if disturbed, and apparently survived for 5–6 weeks in nature. Unfed females laid no eggs, with two possible exceptions, while those given a blood-meal on capture oviposited on damp cotton 3–5 days later. Most of these died a few hours after oviposition. The maximum, minimum and average number of eggs per female were 100, 1 and 55. In July 1947, up to 20 per cent. of the adults taken daily in the field were infested by larvae of a mite (Hydracarina), of which as many as 15 were counted on one female. Infested females either failed to produce eggs or laid a much reduced number, but their life was not shortened.

LINDQUIST (A. W.), KNIPLING (E. F.), JONES (H. A.) & LAAKE (E. W.). **Blow Fly Control with DDT Sprays dispersed from Aircraft.**—*J. econ. Ent.* **41** no. 6 pp. 971–973, 1 ref. Menasha, Wis., 1948.

Reference is made to an unpublished report by H. Hurlbut & C. S. Wilson in which an account is given of an unsuccessful attempt made by the United States Navy in 1944 to control flies breeding in corpses under combat conditions on Peleliu [an island of the Palau or western Caroline group] by treating 1,200 acres six times in two weeks with 5 or 10 per cent. DDT in oil solution applied from aircraft at 0·2–0·6 lb. DDT per acre. The principal species involved was *Chrysomyia megacephala*, F. Each application reduced the numbers of flies by only 30–50 per cent., and as larvae and pupae were apparently unaffected, freshly emerged adults soon replaced those that were killed. Because of this failure to control flies with DDT applied at relatively low rates, an experiment was made in Texas in 1945 to determine whether satisfactory results could be obtained by treating a small part of a large area with a single application of DDT from an aircraft at a dosage sufficient to leave a toxic residue. The DDT was applied at 2 lb. per acre in emulsified and unemulsified oil solution and as a suspension on three adjoining plots, each 250 acres in extent, within a large range area sparsely covered with low, small-leaved brush and trees. The spraying equipment, which was devised by C. N. Husman, is briefly described. The DDT deposits, as estimated from the amounts on glass plates placed at right angles to the line of flight, averaged 100, 78 and 55 per cent. of the amount released on the plots sprayed with emulsified and unemulsified solutions and suspension, respectively. Analysis of samples of leaves from the sprayed vegetation indicated a marked reduction in the deposit (up to 91 per cent.) two weeks after spraying.

Results were evaluated mainly by catches in liver-baited traps. From analysis of a sample, it appeared that *Phormia regina*, Mg., formed about 55 per cent. of the catch and *Callitroga macellaria*, F., about 37 per cent. The reduction in blowfly abundance, as indicated by catches in traps in the centre of each 250-acre plot, varied considerably. The range during the first three days after treatment was 6–68 per cent. Among individual plots, the one treated with the solution was most benefited. Considering the experiment as a unit, control was best (60–76 per cent.) in the centre of the whole sprayed area of 750 acres, which was almost square. It is concluded that treatment of small plots with relatively high single dosages of DDT will not give satisfactory control of blowflies. To obtain maximum control, extensive areas must be sprayed.

ANDERSON (R. F.). **Relation of Droplet Size to Toxicity in Residual-type DDT-Oil Sprays.**—*J. econ. Ent.* **41** no. 6 pp. 974–976, 2 refs. Menasha, Wis., 1948.

When insecticides are applied as sprays from aeroplanes, much of the material may be lost by drifting. This loss may be reduced by increasing the size of the particles so that they will be less affected by wind and air currents, but as an increase in droplet size may change the effectiveness of the insecticide, laboratory tests were carried out to determine the relation of droplet size to toxicity in residual-type sprays of DDT in oil. Technical DDT was dissolved in xylene and fuel oil No. 2 in the early tests and in an alkylated naphthalene fraction in the later ones. Droplets of uniform size were made by momentarily touching the inner bottom surfaces of petri-dish test chambers with the tip of a fine-pointed pipette, the size being altered by varying the size of the pipette openings. Tests against *Drosophila melanogaster*, Mg., showed that toxicity of a given amount of DDT varied inversely with droplet size and that its effectiveness was also increased when its dispersion was improved by using more dilute solutions and consequently a larger number of droplets.

SMITH (C. L.). **Chlorinated Hydrocarbon Insecticides for Control of the Horn Fly on Dairy Cattle in Texas.**—*J. econ. Ent.* **41** no. 6 pp. 981–982. Menasha, Wis., 1948.

Tests were carried out in Texas between May and October 1947 to compare various chlorinated hydrocarbons against *Siphona irritans*, L., on dairy cattle. A spray containing 0·5 per cent. active ingredient was used to treat all herds except one, which received 0·25 per cent. DDT. The sprays were made from wettable powders and were applied with a power sprayer to the necks, backs, sides and abdomens of the cattle at about 2 U.S. quarts per animal. Fly-counts were made twice a week, and the herd was treated again when the population averaged 25 flies per animal. At 0·5 per cent., all the materials tested gave satisfactory control, the average number of days for which protection was afforded being 32 for chlordan, 31 for chlorinated camphene [toxaphene], 29 for DDT, 24 for DDD (dichlordiphenyldichlorethane) and 20 for methoxy-DDT. DDT at 0·25 per cent. protected for an average of 17 days, and this lower dosage would probably be economically desirable. Methoxy-DDT gave the quickest and toxaphene the slowest knock-down. When applied at intervals of 30 days, 4–5 treatments gave adequate protection for the whole season. No animals were injured by any of the insecticides, but until the results of toxicological investigations have been published, it should not be presumed that all are suitable for the control of *S. irritans*.

TAYLOR (D. J.), MULRENNAN (J. A.) & THURMAN (D. C.). **Duration of the Effect of residual DDT Spray in Houses in Florida.**—*J. econ. Ent.* **41** no. 6 pp. 982–983, 2 refs. Menasha, Wis., 1948.

Catches of *Anopheles quadrimaculatus*, Say, in unscreened houses and adjacent natural resting places in Florida during the 1947 season were used in a comparison to determine the effect of spraying interiors to leave a toxic residue of DDT in that year on the populations of *A. quadrimaculatus* in the houses and also the duration of effectiveness of applications of spray made in 1946. The DDT was applied as a 5 per cent. emulsified solution in xylene at about 200 mg. DDT per sq. ft. The extent of infestation of unsprayed houses by *A. quadrimaculatus* varied with its abundance in natural resting places. The percentages of houses harbouring it and (in brackets) the mean number per house were 62·7 (3) for unsprayed houses, 7·6 (0·3) for those treated in 1945 and 1946 or 1946 only, 4·5 (0·1) for those treated in 1946 and 1947 or 1945, 1946 and 1947, and 8 (0·3) for those treated in 1947 only. It is concluded that the sprays applied in 1946 remained effective for 6–12 months, extending into the season of 1947.

MONRO (H. A. U.), BEAULIEU (A. A.) & DELISLE (R.). **DDT Residues. Their Toxicity to Houseflies on various Surfaces and Materials.**—*Soap & sanit. Chem.* **23** no. 8 pp. 123, 125, 127, 129, 143, 145, 4 figs., 3 refs. New York, N.Y., 1947.

The authors give an account of the technique and apparatus used and a report on the results obtained in the first two years in an investigation in progress at Montreal on the toxicity to *Musca domestica*, L., of DDT deposits on various surfaces commonly found in buildings. Kerosene solutions of technical DDT (found in two analyses to contain 76 and 77·4 per cent. p,p′ isomer, respectively) were atomised into the tops of cylindrical spray towers 23 ins. high and allowed to settle on test panels. Tests of efficiency, some results of which are given, indicated that replication and distribution of the deposit at the bottom of the towers were satisfactory. The spray was allowed ½ hour to settle, after which the panels were removed from the towers and left to dry in a horizontal position for 24 hours. They were then fitted into a rectangular wire gauze test cage measuring 6·5×6·5 ins. and 5·5 ins. high, of which they formed three sides and the top, the bottom being masonite (hard pressed wall board) covered with paper and the front wire gauze. The capacity of the cages when the panels were fitted was 125 cu. ins. Between the monthly tests, the treated panels were hung on a rack so that they received direct sunlight in summer but only indirect light with artificial lighting throughout the day in winter. Temperature and humidity were normal for an indoor environment. Cages were cleaned between tests with xylene, washed with hot water and soap and rinsed with boiling water. Flies emerging from pupae 16–40 hours after the beginning of emergence and kept for 4–5 days were used. They were anaesthetised for counting by exposure to a 1 : 1 mixture of chloroform and ether, which was shown to have no significant effect on their susceptibility to DDT. Each cage contained 120 flies, and exposure to treated surfaces was for ten minutes, after which the panels were removed. The flies were left in the cage with food, and mortality counts taken after 24 hours.

The results obtained with deposits of 70, 108 and 149 mg. DDT per sq. ft. on the nine types of surface tested are shown in a graph. A material was discarded from test when the heaviest deposit gave less than 75 per cent. kill on it. No significant increase in mortality with discarded materials was recorded when exposure was raised to 50 minutes. The heaviest dosage was still giving high mortalities after more than 18 months on the two very smooth non-absorptive surfaces tested, glass and masonite, and on planed unpainted pine and " Ten-Test " (insulating wall board), which are comparatively absorptive, and complete mortality after 15 months on wallpaper. Plain cement, fresh painted wood, fresh white-washed cement and cement white-washed one month before being sprayed were discarded after 7–10 months, but significant mortalities should be obtained with them under practical conditions for one summer season, except possibly just after application, when kill was sometimes poor. It is considered that these results show trends that are in agreement with those obtained by Clapp, Fay & Simmons in tests with a mosquito [*R.A.E.*, B **37** 238].

GOODHUE (L. D.), SCHULTZ (F. S.), INNES (N.) & STANSBURY (R.). **A Test Method for commercial Aerosol Dispensers.**—*Soap & sanit. Chem.* **23** no. 9 pp. 119–121, 4 figs. New York, N.Y., 1947.

The following is based on the authors' summary. A rapid method of testing commercial liquefied-gas aerosol formulations against house-flies [*Musca domestica*, L.] in cages in a test chamber is described. Since an exact dosage cannot be predetermined, an approximation is made and the exact amount used is found from the loss in weight of the dispenser. Low, medium and high dosages of each aerosol are compared with similar doses of a standard formula, each series, including the standard, is run three times and for each the average mortality and knockdown are plotted against the average dosage on logarithm-probability paper. The standard formula selected was 2 per cent. pyrethrum extract (20 per cent.), 3 per cent. DDT (aerosol grade), 5 per cent. cyclohexanone, 5 per cent. mineral oil (SAE 30) and 85 per cent. Freon-12 [dichlordifluoromethane].

Page (A. B. P.), Stringer (A.) & Blackith (R. E.). **Bioassay Systems for the Pyrethrins. I. Water-base Sprays against** *Aëdes aegypti* **L. and other flying Insects.**—*Ann. appl. Biol.* **36** no. 2 pp. 225–243, 16 figs., 13 refs. London, 1949.

A bioassay system for the pyrethrins, in which the quantity of toxicant accumulated by flying insects [*cf. R.A.E.*, B **34** 201, etc.], and the responses of the insects are both measured, is described and discussed. The insect chiefly used was *Aëdes aegypti*, L. The amount of toxicant picked up is estimated by applying the pyrethrins in an aqueous solution of aluminium chloride and subsequently analysing the insects quantitatively to determine the amount of aluminium on them. The test mosquitos are allowed to emerge in small wire-framed 6×6×6 in. cages covered with mosquito netting, which, in order to eliminate activity due to handling and change of temperature, are conveyed to the spray room in an airtight, insulated box in which they remain for 20 minutes before spraying begins. When the atmosphere in the spray room has been properly conditioned, the spray is applied vertically upwards by means of a spray gun clamped to the floor, and at a fixed time afterwards the cages are carefully transferred from the box to an open grid where they remain during the exposure period. After this the insects are removed for analysis. The susceptibility of the insects to pyrethrins is measured as the proportionate paralysis after exposure for ten minutes.

When a certain weight of pyrethrins, characteristic for each species, has accumulated on the insects, their activity increases considerably, and at a still higher concentration they become paralysed. These weights are here referred to as the " activation " and " knockdown " thresholds, respectively ; they were $1{\cdot}2\times10^{-7}$ and 6×10^{-7} mg. pyrethrins for *A. aegypti*. The curve obtained by plotting accumulated spray (spray pick-up) against concentration of pyrethrins begins to rise along a sigmoid course when the activation threshold is reached ; it rises steeply, since the amount of insecticide accumulated ceases to be proportional to the pyrethrins concentration, until the knockdown threshold is reached, after which it declines sharply owing to rapid paralysis, reaching a level dependent on the inherent time-lag of paralysis behind the initial presentation of the toxic spray. As this time lag is not sensibly reduced by increasing the concentration of pyrethrins, the curve rapidly becomes a straight line parallel to the concentration axis. The volume of spray represented by this line is only slightly higher than that accumulated by unstimulated insects.

In the case of unstimulated mosquitos, the spray pick-up increases approximately linearly with the dosage (volume of liquid applied per unit air space). The concentration of pyrethrins at which the thresholds become attainable consequently decreases as the dosage is increased. At the higher concentrations, when, except for the lowest dosages, the accumulated pyrethrins exceed the knockdown threshold, the curve obtained by plotting spray accumulation against dosage is sigmoid, with the flatter part covering the usual range of spray dosages. Between the activation threshold and a point slightly beyond the knockdown threshold, an increase in dosage may either increase or decrease the spray accumulated, and since this includes the knockdown range most used in biological assays, the assumption usually implied that accumulation is directly proportional to both dosage and pyrethrins concentration is not valid. At any dosage, paralysis takes place progressively faster as the concentration of pyrethrins is increased to a point at which the insects can accumulate the knockdown threshold weight within the exposure period. At still higher concentrations, the rate of paralysis and the volume of spray accumulated become independent of concentration, and the minimum interval before paralysis intervenes is then about 2·5 minutes. This interval is determined solely by the period required for the spray to diffuse through the cuticle, and from it, the barrier presented is estimated to be 0·2–1·0μ thick [*cf.* A **37** 110], which leads to the conclusion that the site of action of the pyrethrins is probably at the peripheral nerve endings. Whereas the curve representing rate of accumulation of the spray is sigmoid and characteristic of weak drug action until the knockdown threshold is reached, it then approximates to an exponential curve, such as is more usual with powerful drugs.

The rate of accumulation at maximum flight activity increased with increased dosage, but the relatively large amount of spray accumulated from low dosages at maximum flight activity and the relatively small increases that followed large increases in the normal range of dosages for any species suggested that the absolute efficiency of the spray decreases over this range and that this variation should indicate the behaviour of the spray under varying conditions. The ratio between the effective dosage (volume of spray of a droplet size that can be picked up by the insect) and the nominal dosage (total volume of spray applied) may, with reservations, be considered as a measure of the efficiency of the spray. In dry air, the proportion of droplets of an aqueous spray that are too small to be effective is increased by evaporation, and this is equivalent to a reduction of the nominal spray dosage at saturation humidity. This reduction can be calculated from the change in the knockdown pyrethrins concentration produced by lowering the humidity. For *A. aegypti*, a nominal dosage of 66 ml. per 1,000 cu. ft. at 100 per cent. relative humidity was equivalent at 70 per cent. relative humidity to one of 55 ml., and the equivalents of 13 ml. at 100 per cent. were 10 and 7·5 ml. at 70 and 40 per cent. relative humidity, respectively.

Curves of a similar type were obtained with a number of other insects. Furthermore, the ratios between $\log_e$ (knockdown threshold) and $\log_e$ (activation threshold) were approximately constant, indicating that the mechanism of action of the pyrethrins is similar in all the species tested. The activation and threshold values were considerably higher for *Culex pipiens*, L., than for *A. aegypti*. The amount of spray picked up by unactivated adults of *Musca domestica*, L., was fairly low and the concentration at which the activation threshold was reached fairly high. The physiological condition of insects affects their resistance expressed as the threshold toxicity values for pyrethrins and also the position of the peak in curves in which spray accumulation is plotted against pyrethrins concentration, and as a result of the latter, the actual dose received becomes largely dependent on the resistance. The 50 per cent. response range generally adopted for bioassay work has the disadvantage that in all the flying insects studied it includes that level of paralysis generally associated with the onset of the knockdown threshold pyrethrins values, irrespective of spray dosage ; this is less serious in the case of smaller insects such as mosquitos than in larger ones such as house-flies. Since the resistance of an insect is correlated with its weight, and its weight is correlated with the volume of air swept out by its wings, which in turn is connected with the number of spray droplets collected on them, the general form of the spray-accumulation curve can be drawn in part quantitatively from a knowledge of the body weight or the dimensions of the wings and the frequency of the wing-beats. Apart from the volume of air moved out by the wings, the most important factor influencing its form is the amount of spray accumulated by the unstimulated insect, which depends on its hairiness and its normal amount of flight in a non-irritant spray. For the given dosage, the range of pyrethrins concentrations below the activation threshold for *Coccinella septempunctata*, L., was unusually wide, owing partly to low spray accumulation on the smooth, compact cuticle and partly to the relatively high body-weight. Males and females of *Rhagonycha fulva*, Scop., which show considerable sexual dimorphism, had similar knockdown and activation thresholds, but accumulation below the activation threshold was greater for the males, probably because of their greater natural activity, and the knockdown threshold pyrethrins concentrations therefore differed in the two sexes. Immature queens of *Vespula germanica*, F., and *V. vulgaris*, L., showed relatively high spray accumulations owing to the extensive hair-covered regions, but there was considerable difference between the two species, part of which may be due to differences in the number or structure of the hairs.

PAGE (A. B. P.) & BLACKITH (R. E.). **Bioassay Systems for the Pyrethrins. II. The Mode of Action of Pyrethrum Synergists.**—*Ann. appl. Biol.* **36** no. 2 pp. 244–249, 1 fig., 14 refs. London, 1949.

The components of synergistic action are reviewed in the light of recent work [*R.A.E.*, B **31** 48; **33** 87; **34** 34, 61; **37** 159], and an account is given of tests of the action of pure sesamin and isobutylundecylenamide, each applied in aqueous sprays containing pyrethrins against *Aëdes aegypti*, L., by a method already described [see preceding abstract]. It was found that both substances reduced the mean weight of pyrethrins required to paralyse each insect from 6×10^{-7} mg. to a minimum of 2×10^{-7} mg. when they were present in up to equimolecular proportions with the pyrethrins, but that further additions had no effect. The synergists applied alone at concentrations of 0·001–1 per cent. were neither toxic nor irritant to the insects, and their presence in the spray liquid did not affect the volume of spray picked up by unstimulated insects. In preliminary tests in which the two synergists were included in sprays of pyrethrins in oil applied against crawling insects (*Calandra granaria*, L.), they also increased the toxicity of the pyrethrins by three, and there were indications that piperonyl butoxide has a similar effect. In a discussion of the mechanism of synergistic action, it is suggested that a surface complex between synergist and insecticide is formed at the peripheral nerve sheath interfaces [*cf.* **31** 211], resulting in the reorientation of the molecules of pyrethrins to give a more efficient discharge of the resting potential at the interface.

MILLS (H. B.), MARSH (H.) & WILLSON (F. S.). **Cattle Grubs in Montana.**—*Bull. Mont. agric. Exp. Sta.* no. 437, 16 pp., 6 figs., 14 refs. Bozeman, Mont., 1946.

The following is mainly based on the authors' summary of the results of investigations begun in 1943 on the bionomics of *Hypoderma* spp. in Montana, to determine the applicability there of control measures devised for use further south. Both *H. lineatum*, Vill., and *H. bovis*, Deg., occurred throughout the State. Adults of the former appeared from late February until about 20th May. The dates of appearance and disappearance of the adults of the latter were not established, but attacks were most intense from mid-June to mid-July. Calves were most heavily infested with both species and mature cattle least. Yearlings became heavily infested with *H. lineatum* but not with *H. bovis*. Larvae of

H. lineatum sometimes appeared in the backs of cattle as early as the last week in December and emerged from them as late as early April. Larvae of *H. bovis* appeared in the backs of cattle late in March, and the last ones emerged in the latter part of June. Most larvae exposed, after emergence, to temperatures of -10°F. died [*cf.* *R.A.E.*, B **37** 75]. It is doubtful whether temperatures can be depended on to fall as low as this and destroy many larvae in the protected places that they seek after emerging from the backs of the cattle.

In 1944, an experiment was made on the control of *Hypoderma* by spraying the cattle just before the beginning of the flight season of *H. bovis* in early June and again 16 and 34 days later with a DDT suspension, but counts of larvae in the backs of the treated and comparable untreated animals in the following spring showed that the DDT was completely ineffective [*cf.* **34** 173]. The recommended control measure is the application of rotenone sprays to the cattle with a power sprayer to kill the larvae during the 30–40 days between the formation of the holes and the emergence of the larvae from them. Where both *H. lineatum* and *H. bovis* are present, four treatments are needed, the times recommended for Montana being the first ten days of February and March, the last week of April and the first week of June. It is essential that all the cattle in a large area be treated.

Reeves (W. C.), Hammon (W. McD.), Furman (D. P.), McClure (H. E.) & Brookman (B.). **Recovery of Western Equine Encephalomyelitis Virus from Wild Bird Mites (*Liponyssus sylviarum*) in Kern County, California.**—*Science* **105** no. 2729 pp. 411–412, 10 refs. Baltimore, Md., 1947.

Some 1,000 examples of *Liponyssus sylviarum*, C. & F., collected from a recently deserted nest of *Xanthocephalus xanthocephalus* in Kern County, California, in June 1946 were divided into four approximately equal pools and tested for the presence of a neurotropic virus. All the pools caused a fatal illness in mice, and the agents were pathogenic for guineapigs and hamsters also. Three of the four were shown to be the virus of western equine encephalomyelitis. This virus was also isolated in the same month from one of two pools of mites, including *L. sylviarum* and *Dermanyssus americanus*, Ewing, taken from the nest of an English sparrow (*Passer domesticus*) containing two dead nestlings. Infection has been found in nature in *D. gallinae*, Deg. [*R.A.E.*, B **33** 89], but examination in the authors' laboratory of thousands of individuals of this species from encephalitis areas outside California gave negative results. *D. gallinae* was not found in hen houses in Kern County during surveys made over a period of four years.

Sulkin (S. E.) & Izumi (E. M.). **Isolation of Western Equine Encephalomyelitis Virus from Tropical Fowl Mites, *Liponyssus bursa* (Berlese).**—*Proc. Soc. exp. Biol. Med.* **66** no. 1 pp. 249–250, 10 refs. New York, 1947.

In view of the many unsuccessful attempts to demonstrate the presence of virus in *Dermanyssus gallinae*, Deg. [*cf.* preceding abstract], though the agents of both western equine encephalomyelitis and St. Louis encephalitis have been isolated from it [*R.A.E.*, B **33** 88–89, 178, etc.], the part it plays in the perpetuation and transmission of diseases of the encephalitis group is not known, and the search for virus among other blood-sucking parasites of birds was therefore pursued. During this work, the western equine virus was isolated from one out of three pools of *Liponyssus bursa*, Berl., collected from a nest containing two nestlings of the English sparrow (*Passer domesticus*) in Dallas County, Texas, in July 1947. Each pool contained about 300 nymphs and adults of the mite. Attempts to isolate a filterable virus from 11 additional pools of wild-bird mites yielded negative results, and further attempts to demonstrate virus in *D. gallinae* were also negative. Two months after the western virus was isolated from the mites from Dallas County, the eastern equine virus was recovered from the brain of a horse from Jefferson County, where a widespread epizootic was occurring. It thus appears that both the western and eastern types of equine encephalomyelitis were active in Texas at about the same time.

Davis (D. E.). **The Use of DDT to control Murine Typhus Fever in San Antonio, Texas.**—*Publ. Hlth Rep.* **62** no. 13 pp. 449–463, 2 fldg. maps, 3 refs. Washington, D. C., 1947.

The following is based on the author's summary. To determine the value of reducing rat fleas for the control of typhus fever [*cf. R.A.E.*, B **38** 9, etc.], an experiment was carried out in San Antonio, Texas. The south-western part of the city was treated with 10 per cent. DDT dust and the rest untreated. Poisoning of rats was continued in the undusted but not in the dusted area. A crew of ten men inspected 26,832 premises between 4th April and 31st August 1945, dusting all places frequented by rats. In each man-day, 48 premises were dealt with, an average of ¼ lb. dust being used in each. Rats, including both *Mus* (*Rattus*) *rattus* and *M.* (*R.*) *norvegicus*, were trapped and combed before and after the application of DDT. At first, due to the inexperience of the dusting crew, the flea index was very little affected, but it was reduced in June and July. Most of the fleas were *Xenopsylla cheopis*, Roths., but *Leptopsylla segnis*, Schönh., was represented in April, May and June. The blood from rats caught in the same area in May, before dusting, and in September, after dusting, was tested for complement-fixing antibodies. The percentage of young rats having antibodies decreased from 12 to 0 in *M. rattus* and from 31 to 5 in *M. norvegicus*. There was no such decrease in young rats caught in undusted grain mills.

In the experimental area, 20 cases of typhus occurred between 21st May 1944 and 4th April 1945 when dusting began. After the programme started, four cases occurred in treated premises and ten in premises not yet treated. In the control area, 22 cases occurred between 21st May 1944 and 24th May 1945, and 23 cases were traced to it after that time. Seven of these originated in a small untreated slum area similar to a large slum in the experimental area. In addition, eight cases originated in the northern part of the city (a good residential area) which was untreated but not included in the control area.

Prince (F. M.) & Wayson (N. E.). **Plague—the Survival of the Infection in Fleas or hibernating Ground Squirrels.**—*Publ. Hlth Rep.* **62** no. 13 pp. 463–467, 1 ref. Washington, D. C., 1947.

It is known that sylvatic plague recurs from year to year among rodents that hibernate for several months, but it has not been proved whether the infection is latent in the hibernating rodents or persists in their fleas. An experiment is described in which six hibernating ground squirrels (*Citellus richardsonii*) were stored for four months at 40°F. in separate metal containers with tissue paper bedding, and 100 fleas (*Diamanus montanus*, Baker) were confined with each. Two of the ground squirrels were inoculated with plague when hibernation was established, and the fleas enclosed with them were uninfected. One of them was found to have died of plague when it was examined two weeks later, and five fleas recovered from it then produced plague in a guineapig when triturated and injected subcutaneously. The second ground squirrel recovered and was awake after four months, and 23 fleas were found alive at the end of the four months on it or its bedding. They did not produce infection by biting white mice or being injected into them, and their droppings did not contain plague bacilli. Two of the other ground squirrels were each caged with 100 infected fleas, and neither became infected, but one of the 14 living fleas recovered from them after four months retained plague organisms in a virulent form and produced plague when injected into a white mouse. The remaining two ground squirrels were caged with uninfected fleas to determine the chances of survival under the conditions of the experiment. Half of the fleas were recovered at the end of the test period and were able to reproduce.

Thus it was shown that a flea can remain alive and infected with plague in a virulent form for four months in the nest of a hibernating ground squirrel. However, a large proportion of both normal and infected fleas died within this period, and most of those that had been infected and survived did not retain the infection for the four months. The death or complete recovery of the ground squirrels that were inoculated with plague after hibernation was established does not support the theory that infection is carried through hibernation in a latent phase and becomes active when the animal wakens. The fact that fleas became infected when placed with a ground squirrel that later died of plague and the number of flea droppings found in the nests suggest that the fleas fed either while the animals were in hibernation or during the periods of transitory activity of which there was evidence. The greater mortality among the infected fleas and those that probably acquired infection by feeding on the infected ground squirrel than among the control fleas may be explained by inability to feed on account of blocking by the bacilli within them.

UNGUREANU (E.) & SHUTE (P. G.). **The Value of the Wing Scales as an Aid to the Taxonomy of Adult** *Anopheles maculipennis*.—*Proc. R. ent. Soc. Lond.* (B) **16** pt. 7–8 pp. 79–85, 1 pl., 10 refs. London, 1947.

In 1937, the senior author, working in a part of northern Rumania where malaria was endemic, found that the plume and plume-like scales on the wings of adults of different varieties of *Anopheles maculipennis*, Mg., varied in shape and size. On the basis of further studies of examples of *A.m. maculipennis* from Rumania, *A. m. messeae*, Flni., and *A. m. atroparvus*, van Thiel, from Rumania and England and *A. m. sacharovi*, Favr (*A. elutus*, Edw.) from Rumania and Albania, a key is given for separating these by characters of the wing scales, and differences in the shape and proportions of the scales are described. Keys are also given to the males (based on genitalia) and eggs of these four forms and of *A. m. labranchiae*, Flni. However, the latter, of which material from Algeria and Italy was seen, can be reliably separated from *A. m. atroparvus* only in the egg stage. It is claimed that at least some members of the *maculipennis* complex can be classified by the characters of the wing scales with an accuracy of over 90 per cent. and that in accordance with the contention of T. Ginsburg in 1938 (*Zoologica*, N.Y. **23** 253) that a full species occurs when the degree of intergradation is not more than 10 per cent. the recognition of *A. m. maculipennis*, *A. m. atroparvus*, *A. m. messeae* and *A. m. sacharovi* as distinct species is justified. *A. m. labranchiae* was insufficiently studied to warrant a conclusion being drawn.

REID (J. A.). **Type Specimens of Culicidae described by Laveran (Diptera : Culicidae).**—*Proc. R. ent. Soc. Lond.* (B) **16** pt. 7–8 pp. 86–91, 12 refs. London, 1947.

The following is virtually the author's summary. The type material of six species of Oriental and Pacific mosquitos, described by Laveran in 1901 and 1902, has been found in the Pasteur Institute in Paris. The specimens are mounted on slides in balsam. Opinions on these species and their synonymy published by other workers are reviewed. A list is given of the specimens with data on their collection and other relevant information and determinations of the four species of *Anopheles*. According to these determinations, which agree in all important respects with the opinions of Edwards in a work already noticed [*R.A.E.*, B **21** 1], *A. vincenti*, Lav., is a synonym of *A. minimus*, Theo., *A. martini*, Lav., a synonym of *A. barbirostris*, Wulp, and *A. pursati*, Lav., a synonym of *A. hyrcanus*, Pall., and provisionally of *A. hyrcanus* var. *nigerrimus*, Giles. *A. farauti*, Lav., is a valid species (or variety) in the complex of *A. punctulatus*, Dön., agreeing with the *farauti* of Knight and others, who make *moluccensis*, Sw. & Sw., a synonym of *farauti* [**35** 173].

PAPERS NOTICED BY TITLE ONLY.

PAGÁN (C.). **The Use of Guppies** [*Lebistes reticulatus*] **in the toxicological Assay of** *Derris* **and** *Lonchocarpus* [cubé] **Roots.**—*J. econ. Ent.* **41** no. 6 pp. 942–945, 1 fig., 7 refs. Menasha, Wis., 1948. [*See R.A.E.*, A **38** 64.]

BROWNING (H. C.), FRASER (F. C.), SHAPIRO (S. K.), GLICKMAN (I.) & DUBRÛLE (M.). **The biological Activity of DDT and related Compounds.**—*Canad. J. Res.* (D) **26** no. 5 pp. 282–300, 27 refs. Ottawa, 1948. [See *R.A.E.*, A **38** 77.]

BROWNING (H. C.), SHAPIRO (S. K.) & DUBRÛLE (M.). **The insecticidal Activity of DDT and related Compounds against different Insect Species.**—*Canad. J. Res.* (D) **26** no. 5 pp. 301–306, 18 refs. Ottawa, 1948. [See *R.A.E.*, A **38** 78.]

VELBINGER (H. H.). **Beitrag zur Toxikologie des "D.D.T."-Wirkstoffes Dichlor-diphenyl-trichlormethylmethan.** [Contribution to the Toxicology of DDT.]—*Pharmazie* **2** pt. 6 pp. 268–274, 1 fig., 20 refs. Berlin, 1947. **Zur Frage der "D.D.T."-Toxizität für Menschen.** [On the Question of the Toxicity of DDT to Man.]—*Dtsch. Gesundhwes.* **2** pt. 11 repr. 8 pp., 8 refs. Berlin, 1947. (With Summaries in Russian, English and French.) [See *R.A.E.*, A **38** 52.]

PRADHAN (S.). **Studies on the Toxicity of Insecticide Films. III.—Effect of relative Humidity on the Toxicity of Films** [of DDT and dinitro-o-cresol]. —*Bull. ent. Res.* **40** pt. 3 pp. 431–444, 1 pl., 4 figs., 22 refs. London, 1949. [See *R.A.E.*, A **38** 48.]

SEIL (H. A.). **Estimation of Pyrethrins.**—*Soap & sanit. Chem.* **23** no. 9 pp. 131, 133, 1 fig. New York, N.Y., 1947. [See *R.A.E.*, A **38** 77.]

SMIT (B.). **The Control of Household Insects in South Africa (with a Chapter on Rats and Mice).**—*Bull. Dep. Agric. S. Afr.* no. 192 (3rd edn. revd.) 67 pp., 26 figs., 16 refs. Pretoria, 1946. Price 6*d*. [*Cf. R.A.E.*, B **28** 21.]

PHILIP (C. B.). **A Catalog of the Blood-sucking Fly Family Tabanidae (Horseflies and Deerflies) of the Nearctic Region north of Mexico.**—*Amer. Midl. Nat.* **37** no. 2 pp. 257–324, 7 refs. Notre Dame, Ind., 1947.

HAWES (I. L.), MITCHELL (W. H.) & COON (E. L.). **Index VII to the Literature of American Economic Entomology January 1, 1940 to December 31, 1944.**—*Amer. Ass. econ. Ent.*, Spec. Publ. 7 [12+] 1063 pp. College Park, Md., 1948. Price $7.00. [*Cf. R.A.E.*, B **31** 120.]

Picard (J. P.) & Kearns (C. W.). **Analysis of the essential structural Features of DDT by a Study of the Toxicity of closely related Compounds to Roaches and to Houseflies.**—*Canad. J. Res.* (D) **27** no. 2 pp. 59–67, 10 refs. Ottawa, 1949.

Läuger and his colleagues consider that the insecticidal action of DDT is due to the basic toxicity of the linked p-dichlorbenzene rings, which probably act by an enzyme-blocking mechanism, together with the action of the chloroform residue ($CHCl_3$ group) as a lipophilic agent [*R.A.E.*, A **37** 330–331, etc.]. Others have attributed it to the ability of the chloroform residue to liberate hydrogen chloride at the site of action within the insect [A **34** 255], which may be aided by the presence of a naturally occurring catalyst, or to the spatial relationship of the different parts of the molecule. An attempt to provide further information on the relation between toxicity and chemical structure was made by comparing the toxicities of analogues in which the p,p′ substituent varied or was absent with that of the corresponding analogues in which the $CHCl_3$ radical was replaced by $C{=}O$ (benzophenones) or CHOH (benzohydrols), both of which are incapable of dehydrohalogenation. The methods of preparing the three groups of compounds are briefly indicated. The test insects were adult males of *Blattella germanica*, L., which were exposed for 96 hours to deposits from acetone solutions on the inner surface of glass containers, and house-flies (*Musca domestica*, L.), which were exposed in a test cage in a wind tunnel to 0·5 cc. kerosene solution of the compound under test drawn past them in the form of atomised droplets. The benzophenone derivatives showed no toxicity to *B. germanica*, even at very heavy deposits, and neither they nor the benzohydrols were effective against *M. domestica* at concentrations of 5 mg. per cc. Detailed results are given for the tests of the diphenyltrichlorethanes and benzohydrols against *B. germanica* and of the former against *M. domestica*. In tests with *B. germanica*, the median lethal deposits for DDT, its fluoro, bromo, methyl and methoxy analogues and its unsubstituted analogue were 1·15, 0·025, 3·4, 4·6, 3·2 and 15 mg. per sq. ft., respectively. The corresponding benzohydrol compounds showed similar toxicities, and it is therefore concluded that the presence of the $CHCl_3$ group is not essential for insecticidal activity. In the tests with *M. domestica*, the median lethal concentrations for DDT and its fluoro, bromo, methyl and methoxy analogues were 0·17, 0·55, 0·28, 2·2 and 0·8 mg. per cc.; the unsubstituted analogue gave no mortality, and since the unsubstituted anologues were considerably less toxic than the others against *B. germanica*, substitution in the p,p′ positions appears to be necessary for insecticidal potency. The necessity for the substituents to be of limited size is illustrated by the high toxicity found for the p,p′-dimethyl and p,p′-dimethoxy compounds as compared with their next higher homologues. The loss in toxicity in the DDT analogues with increase in the p-alkyl or p-alkoxyl substituents indicates that enhanced paraffinic character is not beneficial even if it favours the oil-solubility of the product.

These results all support the conclusion that the electronegative character of the substituents and the lipophilic action of the $CHCl_3$ group cannot alone account for toxicity, which must depend on the whole shape of the molecule. They also illustrate the importance of testing the toxicity of related compounds on insects of more than one species.

Doner (M. H.) & Anderson (C. V.). **Testing Insecticidal Residues. A Micro Method for biological Testing of non-fumigant Type Insecticidal Residues on the Housefly** (*Musca domestica* **L.**).—*Soap & sanit. Chem.* **23** no. 10 pp. 124–125, 159, 1 ref. New York, N. Y., 1947.

In the method described for testing the effectiveness of insecticidal deposits against *Musca domestica*, L., a small quantity of the liquid is sprayed through a special micro-atomiser on to a test panel in a settling mist tower, and the panel is used to make a box in which the flies are subsequently confined. The resulting knockdown or kill is compared with that effected by a reference insecticide. Formulae are given for three reference insecticides, comprising a suspension and an emulsified and an unemulsified oil solution, each containing 2·5 per cent. DDT. The test panel is a piece of cardboard 6 ins. square, scored and cut so that the edges can be turned up and stapled together to make a box one inch high. A piece of glass serves as a cover. The panels are sprayed before being folded. A special feature of the method is the use of less than 15 mg. active ingredient per sq. ft., so that inactivation is rapid and results are obtained fairly quickly. The flies are in constant contact with the treated surface except while in flight.

Three methods of rating the insecticides are described, one based on the ages at which the deposits effect 50 per cent. knockdown with an exposure of 60 minutes, and the others based on the ages at which they give 50 per cent. knockdown or 50 per cent. kill with the minimum exposure necessary for the reference insecticide to give complete knockdown or complete kill on the first day of testing.

Müller (P.). **Ueber Zusammenhänge zwischen Konstitution und insektizider Wirkung. I. (Dichlordiphenyl-trichlor-äthan-Derivate und verwandte Verbindungen.)** [On the Relations between Constitution and insecticidal Action. I. (Dichlordiphenyltrichlorethane Derivatives and related Compounds.)]—*Helv. chim. Acta* **29** fasc. 6 pp. 1560–1580, refs. Basle, 1946.

This paper is a German version of one already noticed [*R.A.E.*, B **36** 150], expanded by the inclusion of the results for all the five species of insects tested and a short section on derivatives of the diphenyltrichlorpropene group. Practically all the compounds were less effective than those of the DDT and DDD series. Unlike these series, the unsubstituted parent compound was as effective as the difluoro and dichlor derivatives, but in all of them, the dibromo analogue showed low toxicity. Unlike the DDT group, bis(3,4-dimethylphenyl)trichlorpropene was not more effective than the 2,4- and 2,5-isomers ; all three showed a slight activity, whereas the corresponding derivatives in the DDD series were inactive.

Harnden (R. C.). **A new Pest Control Insecticide.**—*Pests* **15** no. 3 pp. 16, 18. Kansas City, Mo., 1947.

Data on the properties of chlordan (Velsicol 1068) and its effectiveness as an insecticide [*R.A.E.*, B **35** 50] are reviewed, and the results are given of further tests in which it was applied as a direct spray against fourth-instar nymphs of the German cockroach [*Blattella germanica*, L.] and adult bed-bugs [*Cimex lectularius*, L.]. At 2 and 4 per cent. in deodorised kerosene (Deobase), chlordan gave 81 and 98 per cent. kill of the cockroaches in 24 hours and 93 and 100 per cent. in 48 hours, and the weaker spray gave 100 per cent. kill in 72 hours. In the same times, the official test insecticide killed 39, 47 and 47 per cent. Against the bed-bugs, 2 and 4 per cent. chlordan in Deobase gave 78 and 100 per cent. kill in 24 hours and the weaker spray gave 98 and 100 per cent. kill in 48 and 72 hours. The O.T.I. gave 64–70 per cent. kill in periods of 24–120 hours. In another series of tests against bed-bugs, the O.T.I. and 2 and 5 per cent. DDT gave kills increasing from 21, 20 and 47 per cent., respectively, in 24 hours to 26, 45 and 86 per cent. in 120 hours.

LEÓN (L. A.) & DE LEÓN (B. C.). **Estado actual de los conocimientos sobre la fiebre recurrente en el Ecuador.** [The present State of Knowledge on Relapsing Fever in Ecuador.]—*Rev. Kuba Med. trop. Parasit.* **3** no. 7 pp. 145–150, 2 figs., 10 refs. Havana, 1947.

The history of relapsing fever in Ecuador is briefly reviewed ; it now occurs in three coastal provinces, being endemic or epidemic in Esmeraldas, which borders on Colombia, and sporadic in Guayas and Manabí. The causal agent in Esmeraldas is considered to be *Spirochaeta venezuelensis*, on the grounds that *Ornithodoros rudis*, Karsch (*venezuelensis*, Brumpt), its habitual vector, is widespread there, it is the agent causing the disease in the neighbouring areas of Colombia [*cf. R.A.E.*, B **31** 178], the clinical picture corresponds to the form of the disease caused by it in tropical America, and injection into rats has given positive results, but no immunological tests have been made. Blood slides show a paucity of spirochaetes, even during febrile periods. In Guayas and Manabí, however, where neither *O. rudis* nor any other Argasid has been found and the infection is characterised by high spirochaete counts such as are typical of the cosmopolitan form of the disease, which has been recorded from Peru, the suspected agent is *S. recurrentis*. It is thought that the vector in these provinces may be *Cimex lectularius*, L., since it is abundant, whereas infestation by lice [*Pediculus humanus humanus*, L.] is rare in the coastal areas and much more common in the mountains.

O. rudis is common in Esmeraldas, especially near the Colombian border, and is highly domestic in habit. It occurs chiefly in old buildings of wood or bamboo, hides during the day in cracks in the walls and floor and emerges at night to feed. It discharges abundant coxal fluid while or immediately after feeding, and engorged females lay 50–100 eggs each. The larvae are active and voracious, and the infection has been shown to be hereditary in the ticks and transmitted by larvae, nymphs and adults. *O. rudis* is considered to be the vector in Esmeraldas because it is the only Argasid found there, it has been shown to transmit the disease in Venezuela, Colombia and Panama [*cf. loc. cit.*], there is a close relation between foci of the disease and its abundance in houses, numerous spirochaetes of the relapsing-fever type have been found in the coxal fluid and tarsi of many examples, and injection of coxal fluid and suspensions of ticks into rats have given positive results. Two Argasids with domestic habits that occur in the mountains to the east of the areas in which relapsing fever is recorded are *O. furcosus*, Neum., which is common in the Interandine Canyon, but has been shown not to transmit *S. venezuelensis* by bite [**32** 109], and *Argas reflexus magnus*, Neum., which is widespread in the valleys of Pichincha and Imbabua, and more voracious than the other ticks mentioned, but has not been tested as a vector of the spirochaete.

In Esmeraldas, cases of the disease increase with the onset of the winter in October and November. The coloured population has acquired partial or total immunity to the spirochaete and is largely neglected by *O. rudis*. The natural reservoirs of the spirochaete are thought to be domestic animals, including fowls and rats, and wild animals that visit houses at night, of which several of those found infected by Clark [*cf.* **19** 213 ; **35** 201] occur in Esmeraldas. The incubation period lasts 5–15 days. The symptoms, clinical forms, diagnosis and treatment of infection with *S. venezuelensis* are described.

PINTO (C.). **Epidemiologia da doença de Carlos Chagas no Estado do Rio Grande do Sul—Brasil.** [The Epidemiology of Chagas' Disease in the State of Rio Grande do Sul, Brazil.]—*Mem. Inst. Osw. Cruz* **44** (1946) fasc. 2 pp. 363–380, 3 fldg. maps, 9 pls., 11 graphs, 9 refs. Rio de Janeiro, 1947.

The author describes the climate of the Brazilian State of Rio Grande do Sul and discusses the distribution, diagnosis and epidemiology there of Chagas' disease, caused by *Trypanosoma cruzi*, based on three years' observations in various localities. The chief points of epidemiological importance found were that *Triatoma infestans*, Klug, an important vector of domestic habits, infests not only huts of mud and straw but also stone houses, where it breeds and shelters throughout the year beneath mattresses, etc., in bedrooms, and that examples of this bug taken from the ruins of huts that had been destroyed over two months previously were infected, even though the temperature fell below freezing point.

DEANE (L. M.). **Observações sôbre a malária na Amazônia brasileira.** [Observations on Malaria in Brazilian Amazonia.]—*Rev. Serv. esp. Saúde públ.* **1** no. 1 pp. 3–60, 3 maps, 3 graphs, 29 refs. Rio de Janeiro, 1947. (With a Summary in English.)

Work on Anophelines and malaria was begun in 1942 in the region of Brazil known as Amazonia, which comprises the States of Amazonas and Pará and the Territories of Acre, Guaporé, Rio Branco and Amapá. The chief characters of the region are described, and the results up to 1946 are shown in numerous tables and discussed [*cf. R.A.E.*, B **36** 39, 142]. Malaria is endemic, with occasional local outbreaks, and the parasite and spleen rates in 1942–44 were 3·1 and 12·6 per cent., respectively. Nearly 30 species of *Anopheles* were taken in the region, but the only two vectors of importance were *A. darlingi*, Root, and *A. aquasalis*, Curry [*cf.* **36** 5].

A. darlingi breeds in water with a low content of sodium chloride and was the chief vector in all but a few coastal localities, where it was not present. Its density was closely correlated with parasite rates, and 1·8 per cent. of 1,556 females dissected showed malaria parasites in process of development. It is highly domestic, 87·8 per cent. of all adults taken occurring in houses, and it represented 75·3 per cent. of all Anophelines taken in houses and only 3·5 per cent. of those taken outside. It is highly susceptible to infection with malaria parasites and was responsible for transmission even in areas in which it was very rare. It entered houses from dusk to dawn, but mostly about midnight, and was not common in them during the day. It was also taken in trains, launches and ships.

A. aquasalis breeds in water with a high content of sodium chloride and was therefore restricted to coastal areas. It was present in almost all those visited. It was an important vector when numerous, but was not common in houses except at certain times of year when adults emerge in large numbers. Of 437 females taken in three coastal areas, including the city of Belém, 0·9 per cent. were infected. *A. albitarsis*, Lynch Arrib., which was represented by var. *domesticus*, Galvão & Damasceno, was common in houses, but appeared to be of significance as a vector only when in association with an important one such as *A. darlingi*. *A. pessôai*, Galvão & Lane, which attacks man in houses, though it is less domestic than *A. darlingi*, or even *A. albitarsis*, was a vector of secondary importance in some areas in which transmission was maintained by other vectors. Other species, though abundant locally, appeared to play no part in transmission.

Anopheline control was attempted in Belém, but larvicides appeared to be of little use against *A. darlingi*, owing to the number and extent of its breeding places and the difficulty of treating their whole surface. Against *A. aquasalis*, a dike was constructed to drain the lower parts of the city and protect them from tidal inflow. It was hoped in this way to render large areas unsuitable for breeding. Pyrethrum sprays were used against adults of *A. darlingi* in houses in some areas, but although they were applied between 6 and 9 p.m., they gave little control of the large numbers of adults entering later. Following promising results with DDT in 1945, sprays of 5 per cent. DDT in kerosene were applied in houses to leave a toxic deposit of 186 mg. per sq. ft. Treatment of whole localities resulted in great reductions in the numbers of *A. darlingi* in some cases, but not when only part of the houses were treated or large breeding places were close. Even in these cases, it was thought that a reduction in transmission might occur, since mosquitos that bit once might not survive to bite a second time. Routine spraying at intervals of 2–3 months was being carried out in some places.

PENIDO (H. M.). **Alguns aspectos da epidemiologia e contrôle da malária na área do Rio Doce.** [Some Aspects of the Epidemiology and Control of Malaria in the Area of the Rio Doce.]—*Rev. Serv. esp. Saúde públ.* **1** no. 1 pp. 61–76, 1 map, 1 graph. Rio de Janeiro, 1947. (With a Summary in English.)

AMARAL (A. D. F.) & PENIDO (H. M.). **Distribuição dos anofelinos no Vale do Rio Doce (percurso da E. F. Vitória a Minas). Espécies transmissoras de malária.** [The Distribution of Anophelines in the Valley of the Rio Doce (along the Vitoria-Minas Railway). Malaria Vectors.]—*T. c.* pp. 163–178, 1 map, 10 refs. (With a Summary in English.)

These two papers refer to a survey of Anophelines and malaria begun in 1943 along a stretch of some 375 miles of the railway that runs from Vitoria, on the coast of Espirito Santo, along the Rio Doce into Minas Gerais. In the first of them, the territory is described, and it is stated that malaria occurs to varying degrees at places along the first 95 miles of the line, until the latter reaches the river, is then, with the exception of one place, absent for some 120 miles, is severe for the next 120 miles and then disappears again. Its occurrence was closely related to that of *Anopheles darlingi*, Root, and it did not occur in the absence of this vector. *A. aquasalis*, Curry, was also present near Vitoria, and *A. albitarsis*, Lynch Arrib., along the first 40 miles of the line. Dissections showed that 7·5 per cent. of *A. darlingi* and 1·3 per cent. of *A. albitarsis* taken in houses contained oöcysts and 1 per cent. of *A. darlingi* sporozoites. Eleven other species of *Anopheles*, a list of which is given, were also taken. The malaria indices at various places are discussed.

Observations along the third and highly malarious section of the railway showed that breeding places of *A. darlingi* were restricted during the dry season (April–November). During the rainy season, when the river floods and all depressions are filled with water, breeding places become very numerous and the high temperature accelerates development, so that adults enter houses in abundance and fresh cases of malaria occur. Control of the larvae is not practicable during the wet season, but is possible during the dry one, and a campaign was begun in two areas in which breeding places were somewhat less numerous. The work consisted of drainage and treatment with paris green, combined with a system of regular inspection. It was hoped to eliminate the infestation during the dry season in these areas. As a result of preliminary experiments with DDT, it was also planned to treat houses regularly three times a year with a suspension to leave a deposit of 186 mg. per sq. ft.

In the second paper, the authors give a list of the Anophelines taken, discuss their distribution along the railway and the incidence of infection among them, and review the literature on Anophelines in the region concerned.

PEREIRA BARRETTO (M.) & PESSÔA (S. B.). **Contribuição para o estudo da distribuição geográfica dos flebótomos americanos (Diptera : Psychodidae).** [Contribution to the Study of the geographical Distribution of the American *Phlebotomus*.]—*Livro Homen. Ferreira d'Almeida* pp. 77–101, 1 map, 10 refs. São Paulo, Soc. brasil. Ent., 1946. (With a Summary in English.)

The author gives a list of 136 species of *Phlebotomus* considered valid (or probably valid) that have been recorded from the American continent and

Trinidad, with their local distribution there and in some cases synonyms, followed by lists of the species that occur in the Nearctic region and the various subregions of the Neotropical region, showing which are peculiar to each and which have a more extended distribution.

Cerqueira (N. L.) & Costa (A. F.). **Duas novas espécies de** *Aëdes* (*Ochlerotatus*) **(Diptera Culicidae).** [Two new Species of *Aëdes* (*Ochlerotatus*).]—*Livro Homen. Ferreira d'Almeida* pp. 133–139, 11 figs., 2 refs. São Paulo, Soc. brasil. Ent., 1946. (With a Summary in English.)

Descriptions are given of the male genitalia of *Aëdes* (*Ochlerotatus*) *aenigmaticus*, sp. n., from Mato Grosso, and the adults of both sexes and the male genitalia of *A.*(*O.*) *perventor*, sp. n., from Rio de Janeiro and other Brazilian States, all taken in 1938 in the course of investigations on yellow fever in 1937–38. The former is very close to *A. serratus*, Theo., and the latter to *A. hortator*, D. & K., the male genitalia of which are figured for the first time, from examples taken in Pará.

Coutinho (J. O.). **Contribuição para o estudo do sub-gênero** *Kerteszia* **com a descrição do macho de** *Anopheles* (*Kerteszia*) *bambusicolus* **Komp, 1937.** [Contribution to the Study of the Subgenus *Kerteszia*, with a Description of the Male of *A.* (*K.*) *bambusicolus*.]—*Livro Homen. Ferreira d'Almeida* pp. 149–153, 2 figs., 9 refs. São Paulo, Soc. brasil. Ent., 1946.

Investigations on species of *Anopheles* of the subgenus *Kerteszia* as vectors of malaria in forest regions in the States of Paraná, Santa Catarina and Rio Grande do Sul, in southern Brazil, were begun in 1943. The four species so far definitely recorded there are *A. cruzi*, D. & K. [*cf. R.A.E.*, B **35** 127], *A. bellator*, D. & K., *A. homunculus*, Komp, and *A. bambusicolus*, Komp [**26** 18]. All breed in bromeliads, and the first two are efficient vectors of malaria and the only vectors known on the coast. Since the male of *A. bambusicolus* has not previously been described, descriptions of the adults and male genitalia are given. This species has not been found to be a vector.

Vaz (Z.) & Rocha (U. F.). *Tunga penetrans* **(L., 1758), "bicho do pé" em gado bovino. Importância clínica, observações parasitológicas e tratamento pelo D.D.T.** [*T. penetrans* in Cattle. Clinical Importance, parasitological Observations, and Control by DDT.]—*Livro Homen. Ferreira d'Almeida* pp. 327–331, 3 figs., 6 refs. São Paulo, Soc. brasil. Ent., 1946.

In view of the scanty references to infestation of hosts other than man and pigs by *Tunga penetrans*, L., the authors record a severe infestation of cattle in São Paulo by fleas thought to be of this species. They were mostly concentrated at the growing point of the hooves, and the resulting ulceration was severe. Secondary infections became established in some cases, and some of the animals were so lamed that they were incapable of walking or even of standing. In tests of control by other than surgical means, five animals were freed from the infestation by treatment of the hooves with a 5 per cent. solution of DDT in benzene, and after this had dried, an ointment consisting of 5 per cent. DDT in vaseline.

Tendeiro (J.). **Tripanosomíases animais da Guiné Portuguesa.** [Trypanosome Diseases of Animals in Portuguese Guinea.]—[*Mem.*] *Cent. Estud. Guiné port.* no. 10, 311 pp., 16 pls., 13 figs., 7 graphs, 2 fldg. maps, 209 refs. Bissau, 1949.

The main features of this work as regards the insect vectors of the trypanosomes of domestic and wild animals in Portuguese Guinea are the same as those in a paper by the author already noticed [*R.A.E.*, B **36** 73], but it has been expanded by the inclusion of more complete lists of the blood-sucking Diptera other than *Glossina* that are or may be responsible for transmission, a discussion of the literature on the possibility of distinguishing mammalian, reptilian and avian blood in *Glossina* by the size of the red corpuscles, information on the susceptibility of the local domestic animals to infection and the animal and bird hosts and distribution of the various species of *Trypanosoma* present there, accounts of the synonymy, morphology and in some cases pathogenic effects of the latter (which include four recently described by the author from birds), and sections on symptomatology, diagnosis and treatment.

LEWIS (E. A.) & LANGRIDGE (W. P.). **Developmental Forms of** *Trypanosoma brucei* **in the " Saliva " of** *Glossina pallidipes* **and** *Glossina austeni*.—*Ann. trop. Med. Parasit.* **41** no. 1 pp. 6–13, 1 pl., 35 figs., 13 refs. Liverpool, 1947.

The following is virtually the authors' summary. A detailed account, based on examination of flagellates in the " salivary " exudate [*cf.* *R.A.E.*, B **37** 137], is given of the development of *Trypanosoma brucei* from the proventricular to the infective metacyclic stages in *Glossina pallidipes*, Aust., and *G. austeni*, Newst. The sequence of development includes a post-proventricular phase of unequal fission or simple gemmation producing short aflegellate crithidia that invade the salivary glands and continue the exogenous cycle to the final metacyclic trypanosomes. The fate of the proventricular trypanosomes and of the long slender crithidia is explained. The rounded forms of earlier workers are excluded from the normal sequence of development of *T. brucei* in the fly. *T. brucei* develops more readily and produces daughter crithidia more frequently in *G. pallidipes* than in *G. austeni*.

FAIRBAIRN (H.) & CULWICK (A. T.). **The Modification of** *Trypanosoma rhodesiense* **on prolonged Syringe Passage.**—*Ann. trop. Med. Parasit.* **41** no. 1 pp. 26–29, 3 refs. Liverpool, 1947.

The following is virtually the authors' summary. A strain of *Trypanosoma rhodesiense* was transmitted in parallel from 1936 by cyclically infected *Glossina morsitans*, Westw., through sheep, and by syringe passages through mice. In January 1946, an examination of these two lines showed that while the cyclically transmitted strain consisted of three forms, short, intermediate and long, the syringe-passaged strain was monomorphic, and consisted solely of the long form. While the mean length of the positively charged long form, in rats, in the cyclically transmitted line was 28·63 μ, that of the positively charged long form, in mice, of the syringe-passaged strain was 23·29 μ, a decrease in length of over 5 μ. In the case of the cyclically transmitted strain, it has been found that a change of host does not alter the length of the long forms significantly. It is shown from the literature that a strain that is syringe-passaged through mice gradually increases in its sensitivity to arsenicals, and evidence is adduced that this is the result of genetic segregation and a loss of plasticity in the strain, produced by constant conditions in the laboratory and the absence of the environmental changes occurring in nature, of which the most important is passage through the insect vector. It is urged that all trials of new drugs should be undertaken with strains of *T. rhodesiense* that are polymorphic and have been, and are being, transmitted by *Glossina*.

BURTT (E.). **Incubation of Tsetse Pupae : the Temperature Range experienced by Pupae kept under normal Laboratory Conditions at Tinde.**—*Ann. trop. Med. Parasit.* **41** no. 1 pp. 50–51, 1 ref. Liverpool, 1947.

In this addendum to a paper by the author [*R.A.E.*, B **37** 135–136], details are given of the temperatures at which pupae of *Glossina morsitans*, Westw., were reared at Tinde, Tanganyika, under normal laboratory conditions; these were inadvertently omitted from the original paper. The mean daily maximum and median temperatures by months from August 1941 to May 1945 are tabulated, with one break of six months. The way in which the pupae were kept is described. The mean daily median temperatures ranged from 21·7 to 28·1°C. [about 71–82·6°F.]. The mean daily maximum temperature sometimes reached or slightly exceeded 30°C. [86°F.] between September and December. Thus, incubation of pupae at about 30°C., which increased the infection-rates and transmissibility of *Trypanosoma rhodesiense* in the resulting flies, did not entail their being subjected to temperatures entirely outside the range experienced by those kept under normal conditions, but whereas the latter experienced such temperatures only for a few hours at a time, the others experienced them continuously.

Hill (M. A.). **The Life-cycle and Habits of** *Culicoides impunctatus* **Goetghebuer and** *Culicoides obsoletus* **Meigen, together with some Observations on the Life-cycle of** *Culicoides odibilis* **Austen,** *Culicoides pallidicornis* **Kieffer,** *Culicoides cubitalis* **Edwards and** *Culicoides chiopterus* **Meigen.**—*Ann. trop. Med. Parasit.* **41** no. 1 pp. 55–115, 2 pls., 21 figs., 75 refs. Liverpool, 1947.

The following is substantially the author's summary of this account of laboratory and field experiments at Liverpool in 1945 and 1946 on the bionomics of six species of *Culicoides* that occur in that area, *viz. C. impunctatus*, Goetgh., *C. obsoletus*, Mg., *C. odibilis*, Aust., *C. pallidicornis*, Kieff., *C. cubitalis*, Edw., and *C. chiopterus*, Mg. The literature on attempts to rear species of *Culicoides* in the laboratory, none of which has been completely successful, and on the distribution, importance, life-cycle and morphology of the genus is reviewed, with particular reference to the morphology, bionomics and distribution of the species studied in this investigation. The techniques used for collecting the immature stages and adults, handling and feeding the adults and rearing the larvae under laboratory and field conditions are described. Attempts to maintain the strains to a second generation were unsuccessful. An account is given of the rearing of *C. impunctatus* and *C. obsoletus*, both in the laboratory and in the field, and of investigations into the habits and incidence of adults and immature stages of these species throughout the year, as observed in Knowsley Park, Liverpool. The sites from which the collections were made are described. Incidental observations on the bionomics of the other four species are also recorded.

C. impunctatus is the most abundant species in the area. By the application of Dyar's law [*R.A.E.*, A **17** 178], it was shown that there are four larval instars. The winter is passed in the last instar, and pupation begins at the end of April or beginning of May. The last fourth-instar larvae and pupae of the overwintered generation were recovered in the middle of July. Fourth-instar larvae were next found at the beginning of November. From May to July, nearly all larvae examined were in the second instar, during August and most of September, second- and third-instar larvae were about equally common, and during late September and October, most were in the third instar. Owing to technical difficulties, no first-instar larvae were recovered. Adults were taken from the end of April until August and were most abundant in June. It would appear that the strain studied normally has one generation per year, its life-cycle in the field lasting 11–12 months. In the laboratory, the larval stage usually occupied five months but sometimes as much as seven. The egg and pupal stages lasted about two weeks and five days, respectively, and about two weeks elapsed between the first blood-meal and oviposition. Up to 65 eggs were deposited in one batch. Females were fertilised in the laboratory.

Adult activity was greatest about half an hour before sunset but continued to some extent throughout the night and early morning. Apparently the adults do not normally fly more than a few hundred yards from their breeding ground. Unlike those of *C. obsoletus*, they have a marked preference for human blood. The immature stages were found only in peaty soil with an acid reaction ; the soil was wet, but not always waterlogged. The male genitalia, egg, larva and pupa are described, the immature stages for the first time.

Larvae of *C. obsoletus*, the next commonest species, began to pupate in April, and pupae were recovered throughout May and during September. The adults were caught during April, May and June, when they were most abundant. A second peak of abundance was recorded at the end of September. It would appear that the Knowsley Park population normally has two generations per year. The life-cycle of individuals reared in the field lasted five months in summer and nine in winter. In the laboratory, the larval stage usually lasted 3½ months but sometimes as much as five. The egg and pupal stages usually lasted 3 and 5 days, respectively. The period between the first blood-meal and oviposition was 17 days, and up to 120 eggs were laid in one batch. Females were fertilised in the laboratory. The immature stages are described. They were recovered from varied situations, all with an acid reaction, including marshy soil and decaying leaves in a tree hole, under a hedge bank and in a ditch.

The limited emergence periods of *C. odibilis*, *C. pallidicornis* and *C. cubitalis* indicate that these species pass through only one generation annually. Descriptions are given of the immature stages of *C. odibilis*, the larva and pupa of *C. pallidicornis* and the female, larva and pupa of *C. cubitalis*, as well as figures of the male genitalia of all three.

Hill (M. A.) & Roberts (E. W.). **An Investigation into the Effects of "Gammexane" on the Larvae, Pupae and Adults of** *Culicoides impunctatus* **Goetghebuer and on the Adults of** *Culicoides obsoletus* **Meigen.**—*Ann. trop. Med. Parasit.* **41** no. 1 pp. 143–163, 6 graphs, 9 refs. Liverpool, 1947.

The following is substantially the authors' summary. The literature concerning previous attempts to control the breeding of *Culicoides* spp. is reviewed. An experiment is described in which an attempt was made at Knowsley Park, Liverpool, in 1946 to control breeding by *C. impunctatus*, Goetgh., the breeding places and bionomics of which were known [see preceding abstract], by spraying the breeding grounds once in late May, before many of the adults had emerged, with a solution of 5 per cent. γ BHC (benzene hexachloride) in miscible oil emulsified in water to give 0·2 per cent. γ BHC and applied at 100 mg. γ BHC per sq. ft. Under the comparatively dry conditions prevailing for the first five days of the experiment, the γ BHC penetrated the soil to a depth of 1 cm., and it killed up to 72–76 per cent. of the larvae and either killed the pupae or prevented the emergence of adults from them. Heavy rain on the fifth day after treatment increased the penetration of the insecticide to 3 cm. Only dead larvae and pupae were obtained in the next four days, and no evidence of breeding was found in the treated ground during the remainder of the normal breeding-season (a further 117 days). Despite persistent wet weather and the waterlogging of the soil throughout the summer, γ BHC was never found in a toxic concentration at a greater depth than 3 cm. and there was no evidence that the lasting toxicity of the insecticide was adversely affected to any great extent by its dispersal by rain. Thus, γ BHC applied to breeding grounds at 100 mg. per sq. ft. in late May not only destroyed the generation due to emerge, but also prevented the development in the treated soil of the generation that would provide the potential adult population of the following summer.

An experiment designed to show whether the attractiveness of black cloth for females of *C. impunctatus* and *C. obsoletus*, Mg., could be put to account in control, by exposing pieces of cloth impregnated with γ BHC, indicated that, although high proportions of the midges alighting momentarily on the cloth are killed, a concentration of at least 250 mg. per sq. ft. of cloth is needed to ensure that its effectiveness will persist even for one week. It is concluded that, under the conditions of the experiment, the exposure of black cloths impregnated with γ BHC in areas infested with *Culicoides* would have no widespread effect on the total population of adults.

Roberts (E. W.). **The Part played by the Faeces and Vomit-drop in the Transmission of** *Entamoeba histolytica* **by** *Musca domestica*.—*Ann. trop. Med. Parasit.* **41** no. 1 pp. 129–142, 4 figs., 27 refs. Liverpool, 1947.

The literature on the dissemination of cysts of *Endamoeba* (*Entamoeba*) *histolytica* by *Musca domestica*, L., is reviewed [*R.A.E.*, B **5** 151 ; **11** 173 ; **30** 114 ; **36** 162, etc.]. Opinions on the importance of the fly in the spread of amoebic dysentery are divergent, and whereas there is ample evidence that it can pick up the cysts and excrete them in a viable condition in the faeces, the part played by the vomit drop has not been examined to any extent. An account is given of experiments in which adults of *M. domestica*, free or held by a wire, were allowed to feed on emulsions containing cysts and vomiting was subsequently induced by exposing the flies on a slide bearing a recently made blood film. The presence of the blood film facilitated the identification of the feeding sites to be searched for cysts. The faecal drops could be clearly seen on it.

Of 107 flies fed on the standard emulsion, 68 excreted 147 faecal drops 5 minutes to 31 hours after feeding, and all the droplets contained cysts. Observation ceased after 31 hours. The average number of cysts per faecal drop was 12. In the vomit-drop experiments, the observation period was limited to nine hours. Of the same 107 flies, 77 produced a total of 384 vomit drops, and 69 produced 199 vomit drops containing cysts. Cysts appeared irregularly in the drops over the whole observation period. Of the 312 vomit drops obtained from the 20 flies that fed without being held, 163 were negative for cysts, 100 had one cyst each and the other 49 had 2–8 cysts.

Further investigations were carried out to ascertain the methods by which the cysts were ingested and discharged in the vomit. Observations on the feeding of free flies indicated that almost all of a liquid food (emulsion containing cysts) and some of a semi-liquid food was ingested through an opening between the labellae and entered the alimentary tract directly along the main food canal (the channel formed by the hypopharynx and labrum), without being filtered through the pseudotracheae. When given dry food, the flies maintained a continuous ejection of liquid. The main food-canal was almost closed and food presumably passed up the pseudotracheae. In experiments in which flies were fed on emulsions containing cysts of *E. histolytica* (diameter 8–13μ), cysts of *E. coli* (12–20μ) and oöcysts of *Eimeria acervulina*(22–25μ), at concentrations of 4, 8 and 25 per field, respectively, the respective concentrations of these bodies found in the crops were 4, 6 and 10 per field. These results suggested that there is a filtering off of particles with a diameter of more than 12μ during the passage of food to the crop, only 40 per cent. of the oöcysts reaching the gut. Three flies observed after feeding on cysts of *Endamoeba histolytica* passed a total of 57 vomit drops containing 30 cysts. Only one cyst of *E. coli* (12μ in diameter) was found in the 51 vomit drops passed by three flies fed on emulsion containing this organism, and no oöcysts of *Eimeria* were found in any of the 47 vomit drops deposited by three flies fed on the emulsion containing them. These results suggest that most of the cysts of *Endamoeba histolytica* that enter the crop are held back by the pseudotracheae when the fly vomits. If the view is accepted that the cysts of *Endamoeba* that appear in the vomit drop are those that became wedged in the pseudotracheal openings until they were washed out by fluid from the oesophageal diverticulum, the virtual absence of *E. coli* and *Eimeria* could be explained by the argument that they were too large to enter the pseudotracheal openings. The relative importance of faecal and vomit drops as sources of infection with amoebic dysentery is difficult to assess, for whereas the faeces contain more cysts they are produced less frequently.

THOMSON (W. E. F.). **Nematodes in Tsetse.**—*Ann. trop. Med. Parasit.* **41** no. 1 p. 164, 5 refs. Liverpool, 1947.

In the course of the dissection of some 1,500 specimens of *Glossina morsitans*, Westw. [in Tanganyika], three examples of a Nematode of the *Mermis* type were found, all in the wet season. References are given to early records of the finding of similar worms in *Glossina* in various parts of Africa. Those now recorded had an average length of 79 mm. and seemed to occupy so much of the abdominal cavity as seriously to incommode the flies. Thus one of the flies had apparently been prevented from ingesting an adequate amount of blood in a single feeding, since it contained two kinds of blood when caught and even then had attempted to attack the collectors, and its fat-contents were those of a hungry fly.

GJULLIN (C. M.), COPE (O. B.), QUISENBERRY (B. F.) & DUCHANOIS (F. R.). **The Effect of some Insecticides on Black Fly Larvae in Alaskan Streams.**—*J. econ. Ent.* **42** no. 1 pp. 100–105, 5 refs. Menasha, Wis., 1949.

An account is given of experiments in Alaska in which DDT, chlordan, chlorinated camphene [toxaphene] and γ BHC (benzene hexachloride) were tested as emulsified solutions and suspensions from acetone solutions against larvae of *Simulium venustum*, Say, and *S. vittatum*, Zett., in troughs and against *S.* (*Eusimulium*) *latipes*, Fries [*sic* ? Mg.], in sections of streams flowing at 2–4 ft. per second. They were also tested, principally in the troughs, against rainbow trout and against larvae of caddis flies of the genera *Hydropsyche* and *Halesus* on which the trout feed. The emulsion concentrates consisted of 25 per cent. toxic chemical, 10 per cent. Triton X–100 and 65 per cent. xylene, and the acetone solutions contained 10 gm. toxicant per litre. Tests were also made in the streams with DDT as a wettable powder or 5 per cent. solution in fuel oil or kerosene and with toxaphene or chlordan in fuel oil or in a mixture of mono- and dimethyl naphthalenes, and with a number of potential larvicides that proved ineffective. These were pyrethrum extract in acetone or kerosene, 2-ethyl-1,3-hexanediol, dimethyl phthalate, dimethylphthalate emulsion, n-butyl mesityl oxide oxalate [Indalone], the mixture of mono and dimethyl naphthalenes, fuel oil and kerosene. All larvicides were applied to the streams to give a constant parts-per-million rate for 15 mins.

The results of the tests are summarised on the basis of effects of the treatments on the Simuliid larvae in the stream and on the rainbow trout and caddis larvae in the troughs. DDT in acetone caused all Simuliid larvae to detach at 0·3 part per million and was non-lethal to the trout at 30 p.p.m. and to caddis larvae at 10 p.p.m. DDT in fuel oil and DDT wettable powder caused all Simuliid larvae to detach at 0·4 and 1 p.p.m., respectively, and were non-lethal to the trout and caddis larvae at 10 p.p.m., the highest dosage tested. DDT in kerosene caused all Simuliid larvae to detach at 0·3 p.p.m. DDT in emulsified solution caused all Simuliid larvae to detach at 0·7 p.p.m., but was toxic to the fish at 5 p.p.m., though not to the caddis larvae. The suspension of chlordan from acetone solution was non-lethal to the trout at 20 p.p.m. and to caddis larvae at 10 p.p.m. but was ineffective against Simuliid larvae at 0·5 p.p.m., the highest dosage tested. Chlordan was most effective in fuel oil, causing complete detachment at 0·5 p.p.m. However, the maximum non-lethal dosage for trout was 6 p.p.m. Toxaphane and γ BHC were less effective against the Simuliid larvae and were toxic to the fish at 1–10 p.p.m.

BLANTON (F. S.), HUSMAN (C. N.), TRAVIS (B. V.) & WILSON (C. S.). **Control of Alaskan Mosquito Adults by Aerial Sprays.**—*J. econ. Ent.* **42** no. 1 pp. 106–109. Menasha, Wis., 1949.

Tests made in Alaska during 1948 on the control of adult mosquitos in boggy and wooded areas with DDT spray applied from an aeroplane were designed to determine the area that it is necessary to treat to prevent infiltration in troublesome numbers from the surrounding unsprayed country, the number of applications necessary to protect a community and the minimum effective dosage. A standard 20 per cent. DDT solution designed for aircraft spraying was used, but it was diluted to contain 10 or 5 per cent. DDT when reduced dosages of 0·05 or 0·025 lb. DDT per acre were desired ; it was applied between 7 p.m. and 3 a.m., when mosquito activity was greatest. The following is substantially the authors' summary of the results. The rate of infiltration of adults into plots 24–30 sq. miles in area was such that re-treatment would have to be carried out every 7–10 days during the height of the season. When only 4 sq. miles were treated, infiltration of annoying numbers of mosquitos occurred within 48 hours. Fair protection of the large area was obtained with four applications of spray during the season. The mean initial reductions in mosquito populations with dosages of 0·4, 0·1, 0·05 and 0·025 lb. DDT per acre were, respectively, 92, 83, 80 and 39 per cent. If one test made under unfavourable wind conditions is ignored, the average reduction effected by the 0·1 lb. dosage was 92 per cent. This dosage is considered adequate when conditions are favourable.

COLLINS (D. L.), NARDY (R. V.) & GLASGOW (R. D.). **Some Host Relationships of Long Island Ticks.**—*J. econ. Ent.* **42** no. 1 pp. 110–112, 1 ref. Menasha, Wis., 1949.

The chief vector of Rocky Mountain spotted fever on Long Island, New York, is *Dermacentor variabilis*, Say [*R.A.E.*, B **37** 204]. Although most of the other species of ticks on Long Island bite man rarely or not at all, they may contribute to the spread of the disease by transmitting it from one wild host to another. A study of the ticks and their hosts was therefore made in 1946 and 1947. Totals of 275 mammals and 74 birds representing 16 and 26 species were examined, and 2,800 ticks were collected. They comprised *Dermacentor variabilis*, *Haemaphysalis leporis-palustris*, Pack., and five species of *Ixodes*. Lists are given of the hosts on which each species of tick was taken, and new host records are noted. Relative abundance on various hosts is also discussed. *Ixodes muris*, Bishopp & Smith, was the predominant species on mammals and practically the only one on birds.

COLLINS (D. L.), NARDY (R. V.) & GLASGOW (R. D.). **Further Notes on the Host Relationships of Ticks on Long Island.**—*J. econ. Ent.* **42** no. 1 pp. 159–160, 1 ref. Menasha, Wis., 1949.

In continued observations on ticks on wild hosts on Long Island [see preceding abstract], 81 mammals of six species (including 45 red foxes) were examined in 1948. The same seven species of ticks were found as in the two previous years, but *Dermacentor variabilis*, Say, was the most abundant. This is attributed to the large proportion of foxes among the animals examined. Notes are given on seasonal abundance as well as on the relative abundance of the various ticks on the different hosts.

PEFFLY (R. L.) & GAHAN (J. B.). **Residual Toxicity of DDT Analogs and related Chlorinated Hydrocarbons to House Flies and Mosquitoes.**—*J. econ. Ent.* **42** no. 1 pp. 113–116, 2 refs. Menasha, Wis., 1949.

The following is based on the authors' summary. Laboratory experiments were carried out against *Musca domestica*, L., and *Aëdes aegypti*, L., with 21 analogues of DDT and 19 other new chlorinated hydrocarbons, which were tested as dry deposits on impregnated twill. DDT was used as a standard of comparison. Only nine of the compounds (all analogues of DDT) caused 90 per cent. mortality or more of one or both species with an exposure of 24 hours, one week after treatment. They were retested with an exposure of two hours one week after treatment and at intervals of four weeks thereafter. Only four of them caused complete mortality of *A. aegypti* when they were a week old and none had as lasting an effect as DDT. The best material was a sample of " DDT byproduct oils ", the composition of which was not known. It gave complete kill for eight weeks, whereas DDT did so for 16 weeks. Four of the analogues were highly toxic to *M. domestica* during the first few weeks, and the best of these was methoxy-DDT (methoxychlor). It remained effective for 12 weeks, and it and 2,2-bis(p-bromophenyl)-1,1,1-trichlorethane [bromo-DDT] were the only analogues that were considerably more toxic to *M. domestica* than to *A. aegypti*. DDT deposits were highly effective against *M. domestica* for 24 weeks. Two proprietary samples of 50 per cent. wettable methoxy-DDT were compared with a standard 50 per cent. wettable DDT powder as deposits on plywood to determine their effect on *M. domestica*. One of the samples was significantly more toxic than DDT at the end of the eighth week. The other was markedly inferior.

CARTER (R. H.) & others. **The Chlorinated Hydrocarbon Content of Milk from Cattle sprayed for Control of Horn Flies.**—*J. econ. Ent.* **42** no. 1 pp. 116-118, 1 fig., 3 refs. Menasha, Wis., 1949.

The amount of chlorinated hydrocarbons, if any, in milk produced by cows sprayed for the control of *Siphona irritans*, L., with water suspensions of commercial wettable powders containing them was investigated in Texas between May and September 1947. The spray was applied to the backs and sides of the cows at about 2·2 U.S. quarts per animal. The concentration of active ingredient was 0·5 per cent. except in two of the four tests with DDT, in which it was 0·25 per cent. Spraying was repeated at intervals from May to September whenever the flies reappeared in annoying abundance. Samples of milk from the sprayed cows were taken weekly. Milking was by machine and ordinary precautions were taken to prevent contamination. The determinations for DDT were made by the colorimetric method, and the results throughout the spraying period from the four dairies where this compound was used are given in graphs. The maximum and average organic-chlorine contents in milk from cows sprayed with DDD (dichlordiphenyldichlorethane), methoxy-DDT (methoxychlor) and toxaphene, each of which was used in two dairies, and with chlordan which was used in one, are tabulated. The amount of DDT detected was never quite as much as 2 parts per million, and was generally far less. The results for DDD appeared to be similar, both from the figures for organic chlorine and from those obtained by the colorimetric method, which are given in the text. The latter were somewhat lower. The other figures suggest that chlordan may be eliminated in the milk, but give no conclusive indications with regard to toxaphene and methoxy-DDT.

LAAKE (E. W.). **Chlorinated Hydrocarbon Insecticides for the Control of the Horn Fly on Beef Cattle in Kansas and Missouri.**—*J. econ. Ent.* **42** no. 1 pp. 143–144. Menasha, Wis., 1949.

Field tests of various chlorinated hydrocarbons for the control of horn flies [*Siphona irritans*, L.] on beef cattle were made in Kansas and Missouri during 1947. All were used as wettable-powder sprays and DDT also as an emulsified solution in toluene, and the concentration was 0·5 per cent. for all but chlordan, which was used at 0·25 per cent. A spray of DDT wettable powder at 0·25 per cent. was included as a control. Applications were made with a power sprayer at about 2 U.S. quarts per animal, and spraying was repeated when the fly population rose to more than 25 per animal. The Missouri herds were less exposed to infestation from untreated cattle than were those in Kansas. The average numbers of days for which protection was given in Kansas and Missouri, respectively, were 30 and 45 with DDT wettable powder, 28 and 48 with DDT in emulsified solution, 24 and 47 with methoxy-DDT (methoxychlor), 25 and 50 with DDD (dichlordiphenyldichlorethane), 27 and 42 with chlorinated camphene [toxaphene] and 19 and 29 with DDT at 0·25 per cent. Chlordan, tested in Kansas, gave protection for only 17 days. It is concluded that all are excellent for the control of *S. irritans*. None injured the cattle or the operator, but sufficient toxicological studies have not yet been made for their use to be recommended.

CARTER (R. H.) & others. **DDT Content of Milk from Cows fed Pea Vine Silage containing DDT Residues.**—*J. econ. Ent.* **42** no. 1 pp. 119–122, 7 refs. Menasha, Wis., 1949.

The investigations described [*cf. R.A.E.*, A **38** 117] include one in which an attempt was made to use house-flies [*Musca domestica*, L.] to detect DDT in cream from milk containing less than 0·5 part per million. The cream was homogenised to make it more digestible, and synthetic creams prepared from butter and skim milk with DDT added were used as a standard of comparison. DDT concentrations of 50 p.p.m. or less could not be definitely detected on the basis of fly mortalities, and as the flies were adversely affected by a cream diet, it appears inadvisable to use *M. domestica* for the biological detection of DDT in milk [*cf.* B **37** 171–172] or to draw conclusions from data so obtained.

FULTON (R. A.), MCBRIDE (O. C.) & SULLIVAN (W. N.). **Toxicity of Residues from Carbon Dioxide-propelled Insecticides.**—*J. econ. Ent.* **42** no. 1 pp. 123–126, 3 refs. Menasha, Wis., 1949.

Carbon dioxide has recently been used as the principal propellent for applying DDT solutions to the baggage compartments of aircraft [since dichlordifluoromethane, though adequate for producing aerosols, does not give a pressure sufficient for applying a spray containing a high percentage of non-volatile materials designed to leave a toxic deposit]. In this paper, which is noticed in more detail elsewhere [*R.A.E.*, A **38** 118], an account is given of the method of charging the containers, and of tests in which various insects were exposed to deposits on aluminium and masonite. Heavy dosages were used, as they were necessary for efficient control of the agricultural pests, and they were more effective on aluminium than on masonite. The best solution contained DDT, piperonyl butoxide, pyrethrum extract, dichlordifluoromethane and methylene chloride (10 : 5 : 5 : 20 : 60) ; the deposit was effective against many insects, including *Periplaneta americana*, L., and also against *Dermacentor variabilis*, Say.

KEARNS (C. W.), WEINMAN (C. J.) & DECKER (G. C.). **Insecticidal Properties of some new Chlorinated Organic Compounds.**—*J. econ. Ent.* **42** no. 1 pp. 127–134, 6 refs. Menasha, Wis., 1949.

The authors summarise preliminary data on the physical and insecticidal properties of 1(or 3a),4,5,6,7,8,8-heptachlor-4 : 7-methano-3a,4,7,7a-tetrahydroindene, a pure compound isolated from technical chlordan by chromatographic absorption and hereafter referred to as **I** ; 1,2,3,4,10,10-hexachlor-1 : 4,5 : 8-diendomethano-1,4,4a,5,8,8a-hexahydronaphthalene, referred to as **II** ; and an oxygenated derivative of **II,** referred to as **III.** **I** is an almost odourless white or yellowish white crystalline solid that melts at 92–93°C., is insoluble in water but fairly soluble in most organic solvents, including refined kerosenes, and slowly decomposes with the liberation of hydrochloric acid in the presence of strong alkalis and probably also when exposed to certain metallic halides. **II** is an almost odourless white crystalline solid that melts at 100–103°C., is very highly soluble in most organic solvents but insoluble in water and is stable in the presence of organic and inorganic alkalis and metallic chlorides even when these materials are in solution with it. **III** resembles **II** in most of its physical properties, but is somewhat less soluble in organic solvents ; its melting point is 173°C., and it is stable to strong alkalis but decomposes in the presence of strong acids.

In spray tests against house-flies [*Musca domestica*, L.] by the wind-tunnel technique [*cf. R.A.E.*, B **38** 41], in which DDT and chlordan at concentrations of 2 mg. per ml. kerosene gave 98 and 100 per cent. mortality, DDT, chlordan, γ BHC (benzene hexachloride), **I, II** and **III** at 0·25 mg. per ml. gave 23, 37, 97, 98, 93 and 100 per cent. kill in 24 hours ; the median lethal doses when the compounds were dissolved in ethyl alcohol and applied to the thorax of flies lightly anaesthetised with carbon dioxide were 20·5, 4, 2·9, 1·7, 1·6 and 1·1 mmg. per gm. body weight. Deposits (50 mg. per sq. ft.) of **I, II, III,** DDT and chlordan, applied to glass plates in acetone, gave 100, 83·8, 100, 73·7 and 93·4 per cent. mortality in 24 hours of flies exposed for 30 minutes five days later, and **III** gave over 60 per cent. mortality after 51 days, but the others had lost their toxicity after 3–4 weeks. Tests on rapidity of action, in which flies were exposed to deposits for ten minutes, showed that this decreased in the order γ BHC, **II, III, I,** chlordan and DDT, except that **II** and **III** were about equal. When solutions of the test materials in dioxane were applied to the abdominal sterna of adults of *Periplaneta americana*, L., and males of *Blattella germanica*, L., **III** was slightly more effective than **I, II** or γ BHC and definitely more so than chlordan against both species. Deposits of 1 mg. per 1,000 sq. cm. were tested against *B. germanica* one or more days after they were applied. All five compounds gave 100 per cent. kill with 24 hours' exposure after one day, but only **III** did so after seven days. It still gave 100 per cent. kill in 24 hours after 28 days and in 48 hours after 42, and 90 per cent. in 48 hours after 49. Even with 48 hours' exposure the other compounds showed no toxicity after 21–28 days.

The results of tests on various agricultural pests are also recorded [A **38** 120].

EADS (R. B.). **Recent Collections of Colorado Fleas.**—*J. econ. Ent.* **42** no. 1 p. 144. Menasha, Wis., 1949.

Particulars are given of the fleas found on 20 field rodents of 11 species taken on collecting trips in Colorado during the summers of 1947 and 1948.

NELSON (R. H.). **A Laboratory Method for evaluating DDT Residues.**—*J. econ. Ent.* **42** no. 1 p. 151, 4 refs. Menasha, Wis., 1949.

The procedure described was used in evaluating the effect of sunlight on DDT deposits from various formulations sprayed on to glass plates [see next abstract]. Flies (*Musca domestica*, L.) reared by a standard method were used when 2–3 days old. They were immobilised by chilling and transferred to a small glass dish, which was inverted over a clean glass plate from which it was separated by strips of cellophane 0·3 mm. thick. The flies were then warmed, and when all had recovered, the cellophane strips were used to pull the dish on to a glass plate bearing the deposit to be tested. The strips prevented disturbance of the crystalline structure. The whole was placed in a screened cage, and after exposure for the desired time, the plate and dish were removed, food for the flies was added and they were left in the cage for 24 hours, after which mortality counts were made. With this method of evaluation, the relative toxicities of deposits of various formulations as well as the mortalities effected with different exposures can be ascertained.

CHISHOLM (R. D.), NELSON (R. H.) & FLECK (E. E.). **The Toxicity of DDT Deposits as influenced by Sunlight.**—*J. econ. Ent.* **42** no. 1 pp. 154–155, 4 refs. Menasha, Wis., 1949.

The results are given of a preliminary study on the effect of sunlight on the toxicity of deposits from seven water suspensions and eight emulsified solutions of DDT that had been sprayed on glass plates. For each test, six plates were placed horizontally at equal distances from one another on a turntable that was rotated while a fine mist spray was applied so that each plate passed through the spray twice. A uniform deposit of about 3 mg. DDT per sq. ft. was obtained. After the plates had dried, one diametrically opposed pair was stored in the dark, and the others were exposed out of doors in uncovered trays on bright days in July and August between 10 a.m. and 4 p.m., one pair for a total period of 32 hours and the other for a total of 64 hours. At other times, they were kept in the dark. Two untreated plates were included with each pair of test plates. At intervals from October to February, adults of *Musca domestica*, L., were exposed to the deposits from the suspensions for 2 and 4 minutes and to the deposits from the emulsions for 4 and 8 minutes by a method already noticed [see preceding abstract]. Mortality on the untreated plates was negligible. The mean mortality percentages for the standard suspension of 1 lb. DDT, 1 lb. pyrophyllite and 4 oz. emulsifier per 100 U.S. gals. were 48·8 after continuous storage in the dark and 41·8 and 33·8 after storage including exposure to sunlight for 32 and 64 hours, respectively. When high-calcium hydrated lime, high-magnesium hydrated lime, micronised sulphur, a clay or bordeaux mixture (which are often included in agricultural sprays) was added to the standard suspension, toxicity after exposure to sunlight was very much lower than after continuous storage in the dark. The difference was greatest in the case of the limes and bordeaux mixture and smallest for sulphur. The effect of adding a dust conditioner (limonite), which was considered representative of iron impurities sometimes found in sprays or on sprayed surfaces, was somewhat similar to that of adding sulphur. The bordeaux mixture had a deleterious effect even when the deposit was not exposed to sunlight.

The DDT deposits from the emulsified solutions caused much lower mortalities than those from suspensions, even when the plates were stored in the absence of sunlight; after exposure to sunlight for as little as 32 hours, mortality from nearly all of them was negligible. Deposits from emulsified solutions in kerosene and xylene to which had been added aluminium powder or titanium dioxide, both of which reflect sunlight, or carbon black or diethylaniline, which absorb it, were all negligible in toxicity after exposure to sunlight, but the spray containing carbon black alone among the emulsions gave a kill comparable with that given by the suspensions in the shorter exposure period after storage in the dark.

Eads (R. B.). **A second Record of *Lipoptena mazamae* from Cattle.**—*J. econ. Ent.* **42** no. 1 p. 158, 1 ref. Menasha, Wis., 1949.

Several examples of *Lipoptena mazamae*, Rond., which occurs commonly on deer (*Odocoileus virginianus*) in Texas, were taken on a cow in that State in July 1947. The only other record of this Hippoboscid from cattle known to the author is one from Georgia. Excellent control of *L. mazamae* on deer that were to be moved from a game reserve in the Gulf Coast region was obtained by spraying with 1 or 2 per cent. wettable DDT at 1 U.S. pint per animal.

Nelson (R. H.), Gersdorff (W. A.) & Gertler (S. I.). **Toxicity to House Flies of DDT and two DDT Analogs.**—*J. econ. Ent.* **42** no. 1 pp. 158–159, 3 refs. Menasha, Wis., 1949.

Tests were made of the relative toxicity to *Musca domestica*, L., of DDT and two of its analogues with the substituents in the para positions when applied in sprays by the turntable method [*R.A.E.*, B **26** 246], and the results are given in tables. A standard pyrethrum spray was included for comparison. The median lethal concentrations of DDT, its bromine and fluorine analogues and pyrethrins were estimated to be 0·24, 0·45, 0·82 and 2·04 mg. per ml., respectively. The knockdown given by the two analogues was lower than that given by DDT at the same concentration.

Hsiao (Tsai-yu). **Epidemiology of the Diseases of Naval Importance in Manchuria.**—*Navmed* no. 958, [1+] v+54 pp., 13 pp. refs. Washington, D.C., Navy Dep., Bur. Med. Surg., 1946.

This is a brief summary, compiled from the literature, of knowledge on the occurrence or possible occurrence in Manchuria of diseases that would constitute a hazard to United States servicemen there. The Arthropod-borne diseases definitely known to occur in Manchuria are plague, visceral leishmaniasis (kala-azar), typhus, malaria and relapsing fever. Plague is one of the most important diseases and, though some outbreaks of the bubonic type have spread from Mongolia or Transbaikalia and pneumonic plague has also been recorded, the common rats, particularly *Mus* (*Rattus*) *norvegicus*, are a reservoir in southern Manchuria, where the chief vector is *Xenopsylla cheopis*, Roths. [*R.A.E.*, B **18** 65]. Visceral leishmaniasis is prevalent in parts of southern Manchuria, including Mukden, where sandflies (*Phlebotomus*) appear to be rare; its transmission by them has been questioned, and some Japanese authors have considered that it may be acquired from the faeces of blood-sucking insects. On the other hand, a record of sandfly fever by Kitahata (1939), not subsequently confirmed, suggested that its distribution was similar to that of visceral leishmaniasis. Malaria is not so serious a health problem as it is in southern China, but it is widespread and has increased greatly in recent years. It is most prevalent from June to October. The only Anophelines that have been found in Manchuria are *Anopheles hyrcanus* var. *sinensis*, Wied., and a species of the *maculipennis* group tentatively identified from the male genitalia as *A. maculipennis* var. *atroparvus*, van Thiel (*labranchiae* var. *atroparvus*). The former is widely distributed in Manchuria and adjacent territories. It is very common and is probably the only vector of malaria in southern Manchuria. The latter was first recorded from Heilungkiang Province in 1937 and was again collected in the same province in 1938. Classical typhus carried by *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.) is one of the most important transmissible diseases and frequently breaks out in various parts of Manchuria. Murine typhus is endemic throughout the country, and intermediate forms also occur [*cf.* **20** 144–145]. The prominent species of fleas found on 240 rats, some of them infected, from two Chinese towns near Ta-lien during an epidemic of sporadic typhus in 1926 were *Xenopsylla cheopis*, which was infected, and *Ceratophyllus anisus*, Roths., which was not. *Polyplax spinulosa*, Burm., is also considered a vector among rats in Kirin. Relapsing fever, carried chiefly by *Pediculus h. humanus*, is common in Manchuria.

Notes are also given on the distribution and sometimes the habits of Arthropods of medical importance. The chief groups discussed are mosquitos, *Culicoides* (with a key to the eight Manchurian species), Simuliids (with a key to six Manchurian species), Muscoid flies, Tabanids, lice, including *P. h. capitis*, Deg., and *Phthirus pubis*, L., as well as those already mentioned, fleas and ticks.

Tarzwell (C. M.). **Effects of DDT Mosquito Larviciding on Wildlife. Part I. The Effects on Surface Organisms of the Routine Hand Application of DDT Larvicides for Mosquito Control.**—*Publ. Hlth Rep.* **62** no. 15 pp. 525–554, 2 pls., 6 figs., 1 fldg. table, 2 refs. Washington, D.C., 1947.

The following is virtually the author's summary of this account of investigations begun in Georgia in 1944. Quantitative sampling of the surface forms and counts of dead organisms on the water surface 24 hours after treatment were the methods used for determining the effects of routine treatment with DDT larvicides.

Routine applications of DDT as a dust caused little apparent damage to the surface organisms, as indicated by gross observations. Paired square-foot surface samples, taken before and 48 hours after treatment, indicated few significant changes due to treatment. The seasonal trend of the population of surface organisms was somewhat affected by routine treatments with dust at the rate of 0·1 lb. DDT per acre, but the changes were not so great as those caused by treatments with solutions of DDT in fuel oil.

Solutions of DDT in fuel oil killed the large surface insects, such as Dytiscids, Gyrinids, Hydrophilids and Corixids, at concentrations as low as 0·025 lb. DDT per acre. However, the kills resulting from applications of 0·05 or 0·025 lb. DDT per acre were proportionately much less than those from 0·1 lb. As was true for treatments with dust, few significant changes resulted from any single treatment. The seasonal effects of routine DDT treatments, as indicated by a comparison of the population of surface organisms in the treated and control ponds, were quite marked. There was an increase in the number of Oligochaeta, Nematoda and Copepoda, and a decrease in the Chironomids, Hemiptera, Coleoptera and Ephemeroptera. Insects as a group decreased in number in the treated ponds, with the largest decrease occurring among the Chironomids.

The net results of these changes are difficult to evaluate, but it appears that there is some reduction in the available supply of fish food. Although the forms that increase in numbers often occur in great abundance, they are much smaller than the forms that are reduced in number, and in general they are not so readily taken by the fish. Reductions noted to date, however, have not been sufficient to affect the breeding stock, and since treatment is in localised areas, it is probably not sufficient seriously to limit the fish population by restriction of the food supply.

MATTHYSSE (J. G.). **Cattle Lice, their Biology and Control.**—*Bull. Cornell agric. Exp. Sta.* no. 832, 67 pp., 4 col. pls., 41 figs., 84 refs. Ithaca, N. Y., 1946.

In view of the importance each winter of cattle lice as pests of dairy and beef herds in the northern United States and the lack of detailed information on their bionomics, an investigation, of which a report is here given, was carried out on the biology and local distribution in New York State of *Damalinia* (*Bovicola*) *bovis*, L., *Haematopinus eurysternus*, Nitzsch, *Linognathus vituli*, L., and *Solenopotes capillatus*, End., the four species that occur there, the relative effectiveness of various insecticides against them, and the best concentrations and methods of application. Seasonal variations in population under different climatic conditions, variations in resistance shown by different breeds of cattle and the economic effects of infestation are also discussed. The lice are all obligate parasites, never normally found off the host. The eggs are attached to the hairs of the host and hatch in 1–2 weeks, there are three nymphal instars and the adults mature 2–3 weeks after hatching. *D. bovis* normally reproduces parthenogenetically, and established populations have few or no males ; but the three species of Anoplura are all believed to require fertilisation for the production of viable eggs.

A detailed account is given of the bionomics of *D. bovis*, which were worked out completely, and notes, partly from observations and partly from the literature, are added on certain aspects of the life-history of the other three species. Data from the literature on the life-history of *Haematopinus tuberculatus*, Burm., which is normally a parasite of the Indian buffalo, but has been reported as a pest of cattle in Australia, Porto Rico and India, are included for comparison. *D. bovis* was reared under artificial conditions off the host at several constant temperatures and humidities by a method described, and the optimum conditions were checked by rearing it on the host. It matured readily at 95°F., but hardly ever did so at 90 or 100°F. At 95°, the optimum range of relative humidity was about 75–84 per cent. All stages were killed by exposure to 115°F. for four hours, and all stages of all the species studied were killed within 24 hours by hard freezing. Temperatures near or slightly below freezing did not kill adults of *D. bovis*. It was shown that eggs off the host could not hatch under the conditions prevailing in farm buildings in winter, and the premises could not remain infested for more than two weeks. The skin temperature of heifers was found to be 92°F. in winter, which was near the optimum, whereas out of doors in summer it was 99–125°F., which is too hot for the louse, though it is possible that certain protected areas of the body, such as the inside of the ears, might be suitable throughout the year. The decrease in louse populations on heifers when they are turned out in spring is shown to be correlated with exposure to sun and not with diet. Improving rations in winter did not decrease infestation at that time. From laboratory rearing data, surveys of skin temperatures on the host and other workers' findings, it is estimated that in winter, the egg stage of *D. bovis* lasts eight days and the cycle from egg to egg 29 days.

None of the Anoplura could be reared off the host, but observations were made on populations enclosed in circumscribed areas on the backs of heifers. The average incubation period for 12 eggs of *H. eurysternus* at a barn temperature of 25–45°F. was 13 days. All the cattle lice in New York occur predominantly in winter, but this species, unlike the others, can be found in some numbers in midsummer, though infestation at that time is limited to the ears. The average incubation period for 34 eggs of *L. vituli* at a barn temperature of 20–45°F. was 11 days. Only four lice were reared through to adult females, the complete cycle from egg to egg averaging 25 days. Five eggs of *S. capillatus* hatched on the host at an air temperature of 25–40°F. in an average of 11 days 5 hours.

The literature on the control of lice on cattle is reviewed, and an account is given of experiments with dusts of rotenone and sulphur in the season of 1941–42 and of investigations in 1942–44 directed to finding satisfactory substitutes for rotenone. The author draws the following general conclusions from his control experiments. Dusting is the best method of controlling cattle lice in New York. Dusts containing 10 per cent. or more of derris or cubé (0·5 per cent. or more actual rotenone), applied at not less than 3 oz. per heifer or cow, can be relied on to control all species. A knapsack-type puff duster with a broad flat nozzle enabled the dust to be applied effectively and economically. Used also at 3 oz. per animal, a dust of finely ground sabadilla seed and wettable sulphur (1 : 10) controlled all species. Nicotine dust was found to have only low toxicity to *D. bovis* and *L. vituli*, the most important species in New York [*cf. R.A.E.*, B **14** 186 ; **32** 100]. Dusts containing thanite, two thiocyanates (Lethane 60 and Lethane B71), methylated naphthalenes (Velsicol AR50 and Velsicol AR60), phenothioxin, a proprietary material of unknown composition and pyrethrum all showed considerable toxicity, but apparently cannot be relied on to give complete control. A combination of Lethane B71 and nicotine showed promise against all species. Hellebore (powdered root of *Veratrum album*) had only low toxicity. Some samples of yam bean (ground seed of *Pachyrrhizus erosus*) showed promise, but were slow in action. *D. bovis* can be controlled by a heavy application of almost any finely divided dry material, such as wettable sulphur, diatomaceous earth or sodium fluoride. DDT has fairly high toxicity to the lice [*cf.* **37** 66, 90, 141] but did not seem to be as effective as rotenone or sabadilla in dusts. Spot dusting as a method of evaluating louse powders was not accurate, mainly because lice migrate too rapidly into the dusted areas. Also, it gives no indication of the duration of effectiveness of the insecticides involved.

The species of cattle lice vary greatly in susceptibility to insecticides ; *S. capillatus* is in general the most resistant, although it is very susceptible to nicotine, *H. eurysternus* is the next in order of resistance, *L. vituli* is apparently the easiest to control of the Anoplura, and *D. bovis* is in general the most susceptible to insecticides. A laboratory method is described by which the toxicity of insecticides to *D. bovis* can be quickly and accurately determined.

PAPERS NOTICED BY TITLE ONLY.

DAMASCENO (R. G.) & CAUSEY (O. R.). **Estudo sobre *Flebotomus* no Vale Amazonico. Parte I. Descrição de** *F. marajoensis, F. pilosus, F. souzacastroi* **e** *F. christophersoni* (**Diptera : Psychodidae**). [A Study of *Phlebotomus* in the Valley of the Amazon. Part I. Description of *P. marajoensis, P. pilosus, P. souzacastroi* and *P. christophersoni*, spp.n.]—*Rev. Serv. esp. Saúde públ.* **1** no. 1 pp. 179–193, 5 pls., 5 refs. Rio de Janeiro, 1947. [Reprint of paper published in 1945 (*R.A.E.*, B **35** 136).]

BIRCH (L. C.). **The intrinsic Rate of natural Increase of an Insect Population.**—*J. Anim. Ecol.* **17** no. 1 pp. 15–26, 34 refs. London, 1948. [See *R.A.E.*, A **38** 91.]

SAUBERLICH (H. E.) & BAUMANN (C. A.). **Effect of Dietary Variations upon the Toxicity of DDT to Rats or Mice.**—*Proc. Soc. exp. Biol. Med.* **66** no. 3 pp. 642–645, 20 refs. New York, N. Y., 1947. [See *R.A.E.*, A **38** 97.]

FIERO (G. W.). **Determination of Chlorine in DDT Insecticides.**—*Soap & sanit. Chem.* **23** no. 10 pp. 147, 149, 151. New York, N. Y., 1947. [See *R.A.E.*, A **38** 96.]

Farrell (E.). **The *Anopheles gambiae* Problem in Brazil and West Africa, 1941–44.**—*Bull. U.S. Army med. Dep.* **8** no. 2 pp. 110–124, 11 figs., 11 refs. Washington, D.C., 1948.

Greatly augmented air traffic across the South Atlantic in 1942 increased the danger of the reintroduction of *Anopheles gambiae*, Giles, into Brazil where it had been eradicated in 1940 [*R.A.E.*, B **31** 214]. Inspection of aircraft on arrival showed that living adults of *A. gambiae* were reaching Brazil in increasing numbers [*cf.* **36** 156], and in January 1943 it was made legally compulsory for pilots of incoming aircraft to keep canopies down and cabin windows closed until the aircraft had been sprayed. However, this law was occasionally violated because the pilots were unfamiliar with the regulations or wished to improve visibility for taxiing, and opportunities thus occurred for mosquitos to escape. A commission that investigated the problem late in 1943 concluded that spraying of aircraft was not adequate to protect South American airports and that the objective should be to make the West African airfields from which the aeroplanes left completely free of *A. gambiae.* With this end in view, the United States War Department assigned a malariologist and additional mosquito control personnel to the Middle East Theatre of War, and in March 1944, 16 officers and 90 enlisted men were engaged in co-ordinated mosquito control activities in Nigeria, the Gold Coast, Liberia and Senegal. These had the object both of preventing the introduction of *A. gambiae* into America and of reducing malaria transmitted by *A. gambiae* and *A. funestus*, Giles, among United States servicemen in West Africa. Measures that had been taken in West Africa between late 1941 and March 1944 by Pan American Airways-Africa, Ltd., and the U.S. Army authorities are reviewed. They were quite inadequate, relying largely on personal protection and being based on the assumption that control over an area with a radius of one mile was sufficient.

The new group of workers extended control zones until catches of *A. gambiae* in the central area had been sufficiently reduced. It was found that the determining factor in dispersion was not the flight range of the mosquito, but the direction and force of the prevailing winds. Sometimes the control zone had to be five miles deep or more. Close co-operation with the French anti-mosquito groups in Senegal and with the British in the Gold Coast and Nigeria was necessary. In the Gold Coast, permanent control of breeding in a large area adjacent to Accra and to the airfield through an extensive system of permanent drainage ditches was envisaged, and though the scheme was incomplete in 1944, much better drainage of the airfield and its neighbourhood was provided than had existed in previous years, and the mosquito population was markedly reduced. The malaria rates among British and United States servicemen at Accra and in Nigeria in 1944, as compared with those for 1943, reflected a degree of control over mosquito breeding that was regarded as satisfactory by the autumn of that year. In Liberia, an airfield and a camp were situated in a jungle clearing close to native settlements. Control activities had to be limited to the area within a mile of the camp and were never effective, and malaria rates among United States servicemen fluctuated with the thoroughness of malaria discipline. Following the removal of the airfield and camp in Senegal from an unhealthy site to a peninsula and efficient mosquito control operations, the malaria rate in Senegal became the lowest for any West African Station. It is hoped that these natural advantages will be used to provide an uninfested port of departure for aircraft from Africa for the American continent. Brazilian officials stationed at Accra and Dakar repeatedly expressed their complete satisfaction with conditions achieved there by July 1944. However, at Accra, prolific breeding of *A. gambiae* and *A. funestus* occurs over wide stretches of low grassland and in streams trickling from low coastal hills. Local species eradication seems at present almost impossible, though if sufficient DDT and aircraft were available, it might be possible eventually to create a barrier zone round the airfield so wide that few if any females of either species could cross it.

CHANDLER (A. C.). **Introduction to Parasitology with special Reference to the Parasites of Man.**—8th edn. (revd.), 9¼×6 ins., xii+756 pp., 273 figs., many refs. New York, N. Y., J. Wiley & Sons, Inc. ; London, Chapman & Hall, Ltd., 1949. Price $6 or 48*s*.

This eighth edition of a well-known textbook [*cf. R.A.E.*, B **33** 194, etc.] has been re-written to incorporate the important advances in knowledge on parasitology of man and domestic animals made during and since the second world war. There are no major changes in arrangement, but a whole chapter is now devoted to Acanthocephala, which were formerly appended to the Nematodes, brief reference is made to Arthropod-borne bacteria, and a short discussion on insecticides and repellents has been included in the introductory chapter to the section on Arthropods. Many of the illustrations are new, and others have been improved.

STRICKLAND (E. H.). *Wohlfahrtia* (**Diptera, Metopiidae**) **Myiasis of Mink in Alberta.**—*Canad. Ent.* **81** no. 3 pp. 58–60, 7 refs. Guelph, Ont., 1949.

Cases of myiasis that occur in infants in Alberta each year very closely resemble those caused by *Wohlfahrtia vigil*, Wlk., in eastern Canada [*R.A.E.*, B **25** 10, etc.], and it is thought that a species of *Wohlfahrtia* must be responsible for all of them. Identification is difficult when the larvae are removed at an early stage, and maggots recovered from older children and adults generally prove to be *Sarcophaga* spp., *Hypoderma* or Calliphorids. Myiasis of the *Wohlfahrtia* type has been recorded from Fort Assiniboine southwards almost to the United States boundary. The adult reared from a larva causing primary myiasis in a rat in 1937 was tentatively identified as *W. meigenii*, Schin., which is a carrion feeder in Europe, though it was suggested that it might be a light form of *W. vigil*, Wlk. [**26** 78–79]. In the following year, D. G. Hall stated that reared and captured specimens from Alberta identified as *W. meigenii* [*cf.* also **32** 107 ; **34** 101] were in reality *W. opaca*, Coq., but he classified a single dark-coloured male taken at Athabasca Landing as *W. vigil*.

In the summer of 1948, an extensive outbreak of myiasis occurred in mink kittens in yards near Edmonton, and cases in young cats, a young rabbit and a blue-fox pup were also reported. Several flies were reared from larvae from the mink and *Felis* kittens, and all the females were typical of *W. opaca* in colour, while the only male conformed to *W. vigil*. All are being provisionally referred to the former species. There was little evidence of any increased infestation of infants.

The history of the outbreak in the most seriously affected yard is given. No cases of myiasis had been observed there for the previous 20 years. The first case was noticed on 7th June, and infestation then increased until there were about twenty new cases daily between 17th and 20th June. The last maggots were removed on 2nd July. Of 429 mink kittens, 135 were infested. The adult mink were not attacked, but three in neighbouring yards became infested later, one in mid-July and two in early August. The presence of moisture on the fur or body surface of the kittens appeared to be a factor determining the site of entry of the larvae. Kittens were examined at least once a day, all larvae found were squeezed from the superficial cavities that they inhabited, and these were treated with ointment and then drenched with Dettol or hydrogen peroxide by the insertion of a syringe. This treatment was entirely successful. No permanent effect could be detected on the condition of the animals, and scars on the pelts were often very difficult to detect. The only losses occurred in the few cases in which the maggots entered the rectum. This always resulted in death.

The most seriously affected yards were scrupulously clean, and the unprecedented extent of the attack by a widespread but normally scarce fly is unexplained. Although larviposition occurred chiefly in the darkened nesting boxes, there was a definite relation between absence of shade at the yards and intensity of infestation. Should conditions in the future justify such action, it is thought that mink myiasis could probably be kept at a low level by planting trees in the yards. This would be simpler than fitting fly-proof doors to the exits of the nesting boxes or spraying surrounding vegetation with DDT [*cf.* also **30** 42].

SNIPES (B. T.). **Beef Cattle freed of Lice in one Treatment Control.**—*Agric. Chem.* **3** no. 9 pp. 30–34, 79, 81, 4 figs., 7 refs. Baltimore, Md., 1948.

In choosing means of controlling lice on cattle, maximum duration of effectiveness is of paramount importance, as the loss of weight and condition resulting from handling is the most considerable item in the total cost of treatment. Following demonstration of the effectiveness of combinations of piperonyl butoxide and pyrethrum against both Mallophaga and Anoplura on livestock in small-scale experiments in 1946 and 1947, extensive field tests involving the treatment of over 5,000 cattle in several parts of the western United States were undertaken in 1947–48. Attention was directed to achieving practical control of severe infestations throughout the season with one application of insecticide. Nearly all the animals were beef cattle. About 4,000 received power sprays, and about 1,000 were dipped. Dusts were used on a few during frosty weather. In many tests, attention was given only to *Haematopinus eurysternus*, Nitzsch, which predominated in every herd treated. Test formulae were all based on combinations of piperonyl butoxide and pyrethrins in a ratio of 20 : 1. The basic formulations were used in various dilutions and also in conjunction with additional materials.

The detailed results are given in a table. Hand-gun application of 5–7 oz. dust containing 0·5 per cent. piperonyl butoxide, 0·025 per cent. pyrethrins and 0·2 per cent. rotenone (as cubé powder) in 80 per cent. sulphur gave 40 per cent. control of motile stages of *H. eurysternus* in ten days and 100 per cent. in 30 days, and practical control lasted for more than four months. The concentration of piperonyl butoxide in spray and dip formulations containing only this and pyrethrins as active ingredients ranged from 47·6 to 113 mg. per 100 ml. All applications gave complete or practically complete kills in 5–14 days. Duration of action appeared to be correlated with concentration. Results varied somewhat with the method of application and the area, but practical control of Anoplura for a whole season with one application appeared to require at least 75 mg. piperonyl butoxide and 3·75 mg. pyrethrins per 100 ml. spray or dip. No great difference was evident in the duration of effectiveness of wettable powders and emulsifiable concentrates, but emulsions seemed to give somewhat more effective deposits and to be somewhat more rapid in initial action. A concentration of 12 mg. piperonyl butoxide and 0·6 mg. pyrethrins with 60 mg. DDT per 100 ml. gave complete initial kill, with reappearance of infestation at 3 and 4 weeks and practical control for 2 and 3 months. When the DDT content was increased to 250 mg., control was extended to more than four months. There is some indication that the addition of sulphur increases the effectiveness of low concentrations of piperonyl butoxide and pyrethrins, but there was no evidence in the one test made that its inclusion prolonged the toxic action.

In all cases where *Damalinia* (*Bovicola*) *bovis*, L., was numerous enough for specific evaluation of results, it was apparently eliminated by a single treatment. Relatively high infestations of this louse on three herds in Arizona disappeared immediately after the application of piperonyl butoxide and pyrethrins (at 71 and 3·5 mg. or 100 and 5 mg. per 100 ml.) in power sprays prepared from wettable powder or emulsifiable concentrate, and no reinfestation was found on test animals 5, 14, 30 or 60 days after treatment. It is concluded that with thorough power spraying or dipping, a single application of emulsion containing 100 mg. piperonyl butoxide and 5 mg. pyrethrins will give satisfactory control of both Anoplura and Mallophaga on beef cattle. A spray containing 100 mg. piperonyl butoxide, 5 mg. pyrethrins and 30 mg. rotenone (as cubé) per 100 ml. consistently gave complete kill of lice in 5–14 days and practical control throughout an observation period of 64–150 days and also high kill of cattle grubs [*Hypoderma*]. During the period of heaviest infestation, a batch of treated cows made an average gain of 83½ lb. per head, while untreated animals averaged a gain of 10½ lb.

In an incidental experiment, the ears of nine young cattle with 10–15 spinose ear ticks (*Otobius megnini*, Dugès) in each ear were treated with small amounts of an emulsion of piperonyl butoxide and pyrethrins. After 15 days, eight animals were free of ticks and the other had one. Treatment with about 2 oz. per ear of an emulsion containing 400 mg. piperonyl butoxide and 20 mg. pyrethrins per 100 ml. is suggested for the control of this tick.

GRUNDEMANN [*i.e.* GRUNDMANN] (A. W.). **Studies on the Biology of *Triatoma sanguisuga* (Leconte) in Kansas (Reduviidae, Hemiptera).**—*J. Kans. ent. Soc.* **20** no. 3 pp. 77–85, 11 refs. Manhattan, Kans., 1947.

The bionomics of *Triatoma sanguisuga*, Lec., were studied in Kansas, because it has been found infected with the virus of western equine encephalomyelitis in that State [*R.A.E.*, B **29** 38; **33** 111]. The apparatus and technique used to maintain cultures and to rear individuals for life-cycle observations are described. The natural host in the region of Manhattan was found to be *Neotoma floridana baileyi* [**33** 111], the common local wood rat found in the pastures along the hillsides. *Sigmodon hispidus texianus*, man, horses and fowls were among the occasional hosts. Adults and nymphs were found in cracks and crevices among stones in or near the rodents' burrows, particularly those that had a more or less constant micro-climate and remained dry throughout the year. The nymphs were negatively and the young adults positively phototropic. The active season lasted from the middle of March to the middle of November, but some individuals became sluggishly active on warm winter days. Eggs were laid from early May until mid-September. Particulars of date of collection and instar or sex are given for the 375 individuals taken for experimental purposes between May 1940 and November 1941. The various instars occurred in approximately equal numbers, except for the first, some of which were probably overlooked.

In the laboratory, with no allowance for seasonal inactivity, the life-cycle lasted about 450 days. It was estimated that under natural conditions in Kansas it would occupy about three years. There were eight nymphal instars of approximately equal duration. Most nymphs fed once in each instar. In these, the average length of each instar was 36 days. Some fed twice, and these had presumably been disturbed during the first meal so that engorgement was not complete. The adult females lived for up to 102 days, feeding three times, and laid 7–15 eggs after each blood-meal. Feeding occurred only in darkness. At temperatures below 80°F., 1–3 eggs were laid daily and they hatched in 13–32 days at this temperature. Above 80°F., 3–5 eggs were laid daily and they hatched in 13–23 days. Humidity did not appear to affect oviposition or development, except as regards moulting. In general, high humidity was avoided. Females that were prevented from pairing retained the first group of eggs in the body until death. Each female apparently mated only once.

Its long life-cycle and readiness to feed on a wide variety of hosts could make *T. sanguisuga* an important factor in the maintenance of equine encephalomyelitis among rodents and other wild animals in eastern Kansas.

Young (E. G.). **Stability of Aerosol Formulations.**—*Soap & sanit. Chem.* **23** no. 11 pp. 116–117, 152a, 1 fig., 4 refs. New York, N.Y., 1947.

The author describes further investigations of substances thought likely to inhibit the corrosion that takes place in metal cylinders containing aerosol solutions and so increase the stability of the solutions [*cf.* *R.A.E.*, B **37** 102, etc.]. Sealed glass tubes of about 13 ml. capacity, each containing 5–6 ml. of a solution of DDT, pyrethrum concentrate (20 per cent. pyrethrins), APS-202 oil and Freon-12 [dichlordifluoromethane] (3 : 2 : 10 : 85), a strip cut from a commercially available one-pound aerosol container and the test compound dissolved in oil, were kept at 150°F. for six months, and periodical examinations were made of the condition and amount of corrosion of the strip, the character of the deposit on the glass and the condition of the liquid. The range of compounds tested covered most of the types recognised as corrosion inhibitors in a wide variety of systems. Salicylal amino guanidine, propylene oxide and dodecyl mercaptan proved to be excellent stabilisers of the aerosol formulation, and pinene thiophosphite, petroleum sodium sulphonate and 2-mercaptobenzothiazole had definite stabilising effects and may be considered satisfactory for use in aerosol formulations, but none of the amines, nitro compounds, quinone–type compounds or substituted 2-mercaptobenzothiazoles was sufficiently effective. It is not known what particular function the inhibitor performs in this aerosol formulation, and it is therefore difficult to predict the action of untested compounds.

It is concluded that the stability of solutions of DDT and pyrethrum in Freon-12 for insecticidal use can be improved by adding 0·001–0·1 per cent. by weight of any of the six substances found effective. The low concentrations at which they are used minimise any disadvantageous properties they may have.

Schmitz (W. R.) & Goette (M. B.). **Penetration of DDT into Wood Surfaces.**—*Soap & sanit. Chem.* **24** no. 1 pp. 118–121, 2 figs., 5 refs. New York, N.Y., 1948.

When DDT sprays are used to leave a toxic residue for the control of flies and mosquitos, effectiveness may be supposed to be related to the amount remaining on the surface. When a solution or emulsified solution of DDT is applied to wood, the solvent penetrates into the wood and carries some of the DDT with it. This DDT doubtless becomes unavailable to the insects. An account is given of an investigation made to evaluate some of the factors that affect the penetration of wood by DDT. The following is substantially the authors' summary. The penetration of poplar wood by DDT from a 5 per cent. solution in kerosene or a 5 per cent. emulsified solution in xylene was determined at various depths. About 30 per cent. of the DDT from the kerosene solution and about 38 per cent. from the emulsion were deposited within 0·001 inch of the surface. It was necessary to remove about ⅛ in. of the wood to insure complete recovery of the DDT. The solvent used to make an emulsion affected the degree of penetration. Generally, more DDT was recovered close to the surface when the solvents were comparatively volatile. Of those tested, xylene allowed the recovery of most DDT. An increase in concentration of DDT in the solution or emulsified solution improved recovery near the surface when application was made at 200 mg. DDT per sq. ft., but coverage was best on poplar with a concentration of 5 per cent. The penetration of a 5 per cent. solution in kerosene and a 5 per cent. emulsified solution was determined on woods of various kinds differing in hardness, specific gravity, and number of growth rings per inch. There was little correlation between the physical properties of the wood and the recovery of DDT close to the surface. Poplar wood that had been sprayed with water and then with DDT after 15 minutes had elapsed allowed better recovery than dry poplar wood. In all tests, recovery was better from the emulsion than from the solution.

Gould (G. E.). **The newer Insecticides against Roaches.**—*Soap. & sanit. Chem.* **24** no. 3 pp. 147, 149, 177, 179, 3 refs. New York, N.Y., 1948.

Between October and spring in 1944–47, the author tested various dusts against the German cockroach [*Blattella germanica*, L.] by allowing them to settle for eight minutes on a tray in a settling chamber and confining young adults in the tray for eight minutes. Results for each sex (mortality in 96 hours and average survival time) are given separately in tables, but only those for females are discussed, as this sex was the more resistant.

In 1944–45, samples of DDT powders from different sources and with different diluents showed considerable variation in effectiveness. Pyrophyllite was the best of the diluents tested. The most effective powder gave complete kill of females at a DDT concentration of 5 per cent. A commercial mixture containing 20 per cent. azobenzene alone or diluted to 10 per cent. with pyrophyllite gave nearly complete kill, but only 25 per cent. when diluted to 5 per cent. strength. At 10 and 15 per cent. with pyrethrum marc as the diluent, kills were complete and action much more rapid. When exposed to air, the mixture diluted to 10 per cent. with marc lost most of its effectiveness in 11 days, but after being kept in a sealed container for 12 and 62 days, it still gave 100 and 75 per cent. kill, respectively.

Several new insecticides were used in 1945–46. Results with DDT were best from a micronised sample. Toxaphene at 5 per cent. and a BHC (benzene-hexachloride) mixture containing 0·5 per cent. γ BHC both killed all females. Pyrethrum marc apparently had no activating effect on the BHC. Chlordan gave 98 per cent. kill at 2 per cent. dilution but only 82 per cent. kill at 1 per cent. and was not activated by marc. Calcium dicyanimide, which gave complete kill at 25 per cent., was better than zinc dicyanimide, which, however, gave complete kill at 25 per cent. when 75 per cent. marc was added to the mixture. Sodium fluoroacetate gave a 90 per cent. kill at 1 per cent., but would not be a practicable poison against cockroaches because of its great toxicity to mammals. A 10 per cent. dust of sodium fluoride and a 25 per cent. dust of sodium fluosilicate, the two standard insecticides for cockroach control, were included for comparison and killed 48 and 49 per cent., respectively. A 10 per cent. sabadilla dust gave 75 per cent. kill, but the addition of marc, boric acid or sulphur decreased its effectiveness.

In tests in 1946–47 in which several insecticides were tried at a series of dilutions, samples of BHC from different sources varied considerably in effectiveness. The most effective gave 98 per cent. mortality at a concentration equivalent to 0·2 per cent. γ isomer, whereas a sample of pure γ isomer gave no mortality at this concentration. All samples except the latter had the strong odour characteristic of BHC and would be unsuitable for use in houses or premises where food is dealt with. Dusts containing 0·25 and 0·1 per cent. parathion gave 100 and 98 per cent. kill, and hexaethyl tetraphosphate and tetraethyl pyrophosphate also gave good kills. Toxaphene gave complete kill at 2·5 per cent. and 80 per cent. kill at 1 per cent. Both DDT and chlordan failed to give complete kill at concentrations below 5 per cent. In these tests, sodium fluoride gave only 90 per cent. kill at 50 per cent. dilution. Three commercial mixtures containing piperonyl cyclohexenone [piperonyl cyclonene] and pyrethrum extract were tested during the three years. They gave good kills when freshly-opened, but killed by contact action and had little lasting effect. Various other materials, a list of which is given, were tested but gave little or no kill.

Block (S. S.). **Insecticidal Surface Coatings.**—*Soap & sanit. Chem.* **24** no. 2 pp. 138–141, 171; no. 3 pp. 151, 153, 6 figs., 12 refs. New York, N. Y., 1948.

The literature on the insecticidal effectiveness of DDT incorporated in paints and protective coatings is reviewed, and an account is given of tests of its relative efficiency in different surface coating materials. Evaluation was by observation of the knockdown rate of house-flies [*Musca domestica*, L.] exposed in a cage measuring 5×5×5 ins. lined with treated panels of metal on the sides and bottom. The top was transparent plastic with a hole for introducing the flies. A list of the coating materials, in which 20 per cent. DDT (dry weight) was incorporated, is given in a table and the times for 50 per cent. knockdown when the coatings were first applied and after a specified interval are shown. The toxicity of the film showed a definite increase with time with nearly all the types of coating material tested, but the time required for maximum toxicity to be attained differed. The effectiveness of one film reached its maximum in one week, whereas that of another increased for two years. The more toxic coatings attained their maximum effectiveness within a relatively short time.

In general, oil films or oil-modified resins produced coatings having rather poor insecticidal qualities. Among the vehicles derived from naturally-occurring materials, an asphalt varnish produced by heating gilsonite was outstanding, as it produced a DDT film that gave 50 per cent. knockdown in 13 minutes immediately after application and in 7 minutes after 6 weeks. Waxes in general produced a film of fair insecticidal potency. Backamine P-138, a urea-formaldehyde resin, was outstanding in the group of purely synthetic resins, both for the toxicity of the DDT film formed with it and for the short time required to attain that toxicity. The film gave 50 per cent. knockdown in 10 minutes at the initial test and in 8 minutes after one week. The resin is clear and colourless, and appeared to have excellent qualities for insecticidal coatings. Although the water-dispersible vehicles such as casein and glue with high concentrations of DDT were not so toxic as had been expected, concentrations as low as 1 per cent. DDT in casein gave 50 per cent. knockdown in less than one hour.

The effect on the insecticidal qualities of several DDT-coatings of adding an inert pigment (titanium dioxide) was also studied. A drying-oil coating was appreciably more toxic when enough pigment (60 per cent.) was added to absorb the oil and produce chalking. The effect of the pigment in breaking up the glassy surface of a silicate coating was shown in a marked decrease in knockdown time. A similar result was obtained by abrading the surface of the silicate coating with emery paper. Abrading the oil coating surface, however, did not affect the toxicity of the film. The toxicity of urea-formaldehyde and nitrocellulose coatings was not improved by the pigment, as crystals of DDT were readily formed on their surfaces.

Tests in which the flies were exposed for various periods showed that they acquired a toxic dose very rapidly. After contact for 10 seconds with the non-pigmented urea-formaldehyde resin containing 20 per cent. DDT, half of the flies were knocked down in 40 minutes and all in 150 minutes. With 45 seconds' contact, all flies were knocked down within 41 minutes. The same resin and insecticide with the pigment knocked down all the flies in 51 minutes after contact for one minute. With continuous contact, the resin and pigment with 1 per cent. DDT knocked down half the flies in 29 minutes, but the times for limited contact showed that for practical use at least 5 per cent. DDT is needed. There appeared to be little advantage in using more than this.

Urea-formaldehyde coatings are generally used in baking enamels and are considered too brittle for use by themselves as the binding agent in paints. In view of the excellence of urea-formaldehyde as a vehicle for DDT, plasticising was examined. Of five plasticisers tested at 20 per cent. of the weight of the resin, dimethyl phthalate had no adverse effect on toxicity but is rather too volatile. Castor oil, which reduced toxicity only very slightly, is considered preferable. DDT itself had a plasticising effect.

Tests with several other insecticides in surface coatings prepared with three vehicles indicated that DDT and γ BHC (benzene hexachloride) were the only ones that had a lasting rapid action against flies. Tested at 50 per cent. in urea-formaldehyde against adult American cockroaches [*Periplaneta americana*, L.], γ BHC caused complete knockdown after contact for $1\frac{1}{2}$ hours, chlordan after 18 hours and DDT after 48 hours. Coatings containing toxaphene and DDD (dichlordiphenyldichlorethane) showed no toxicity to the cockroaches in 48 hours. None of the coatings was toxic after contact for one minute.

Suggestions are made for the specialised use of coatings of various kinds containing DDT or other insecticide.

Higgins (A. E. H.) & Green (A. A.). **A combined Hand- or Power-operated Sprayer for Fly and Mosquito Control.**—*Ann. appl. Biol.* **36** no. 3 pp. 383–393, 2 figs., 1 ref. London, 1949.

The following is virtually the authors' summary. A description is given of a new sprayer that was designed in 1945 for the control of adult flies and mosquitos with insecticides having a kerosene base. It has been shown in laboratory tests against *Musca domestica*, L., and *Aëdes aegypti*, L., to be highly efficient for both kill and knockdown and to achieve a particularly rapid knockdown of mosquitos. It can be operated with a hand pump or connected to a supply of compressed air. Air consumption is very low and optimum biological efficiency by power-operation is obtained with an air pressure of 20 lb. per sq. in. There is no spitting or dribbling from the nozzle, and the mist does not settle so rapidly as to cause any appreciable staining of the floor. Although robust, the sprayer is light and easily manipulated and can be dismantled into component parts for cleaning. It has no adjustments ; but the nozzle, which must be machined with precision, is automatically set in its most effective spraying position when screwed home tightly.

de Caires (P. F.). **DDT and *Aedes aegypti* Control in British Guiana.**—*P. R. J. publ. Hlth* **22** no. 4 pp. 405–415, 5 figs., 1 ref. Brattleboro, Vt., 1947. (Also in Spanish pp. 416–424.)

An account is given of an experiment begun in 1945 on the effectiveness and economic practicability of spraying the interior of houses with DDT in kerosene to leave a toxic residue to control *Aëdes aegypti*, L., in British Guiana [*cf.* *R.A.E.*, B **37** 41–42]. A complex system of storage of rain water for drinking makes its control extremely difficult. The experiment was carried out in two adjoining villages near Georgetown in which the *aegypti* index (percentage of houses in which *A. aegypti* bred) was 26 per cent., and the area was divided into four parts to compare the effects of one application of DDT (72 per cent. p,p'isomer) at 5 or 2·5 per cent. with those of the routine control measures

[**28** 18] and no treatment. The stronger spray reduced the index to 0 in 13 weeks and maintained it at 0 for the ten months of observation. The effect of the three treatments from the fifth to the 35th week are shown in a graph. The weaker DDT solution reduced the index to 1 in 13 weeks and kept it at 2 or below. Routine control measures resulted in an index fluctuating between 1 and 5 throughout the period for which results are shown, and they were more expensive. In the untreated area, the index showed no significant variation. Counts of breeding places showed that DDT was less effective than routine control measures against *Culex fatigans*, Wied. (*quinquefasciatus*, auct.). The technique and equipment used are described. Both were considerably improved in the course of the experiment, with consequent decrease in costs.

MACCHIAVELLO (A.). **Cutaneous Arachnoidism or Gangrenous Spot of Chile.**—*P. R. J. publ. Hlth* **22** no. 4 pp. 425–466, 5 figs., refs. Brattleboro, Vt., 1947. (Also in Spanish pp. 467–505.)

In addition to severe and generalised poisoning of the nervous system caused by *Latrodectus mactans*, F., two other types of poisoning caused by spider bite occur in Chile. One is a localised cutaneous gangrene very consistent in the kind of lesion produced and the lack of general symptoms, and the other a viscero-cutaneous affection much less frequently seen in which the cutaneous signs are accompanied by symptoms of hepatitis with jaundice, haematuria, fever and slight nervous disorders. Numerous cases of the first and two of the second seen by the author are described. Examination of some of the spiders responsible showed that both types are the result of bites by *Loxosceles laeta*, Nicolet [*R.A.E.*, B **26** 212]. There is no satisfactory explanation for the occurrence of generalised symptoms in a few cases only. A description of one case of poisoning by *Latrodectus mactans* is given for comparison. The symptoms and course of cutaneous gangrene are discussed in detail and compared with the effects of the bite of *Latrodectus mactans*, and some cases of the former described in the literature are reviewed. Attacks by *Loxosceles* were often associated with very hot weather. The reason for this is not known. They usually occurred in the home.

ROZEBOOM (L. E.). **Taxonomic Notes concerning** *Phlebotomus osornoi* **Ristorcelli and Van Ty, 1941 (Diptera, Psychodidae).**—*Proc. ent. Soc. Wash.* **49** no. 7 pp. 177–182, 8 figs., 4 refs. Washington, D. C., 1947.

The male of *Phlebotomus osornoi*, Ristorcelli & Dao Van Ty, is described and additional descriptive notes are given on the female [*cf. R.A.E.*, B **31** 11], together with characters distinguishing both sexes from those of related species, including *P. noguchii*, Shannon [**17** 189]. Hertig believed that the female described by Shannon as *P. noguchii* [**17** 190] was actually an example of *P. verrucarum*, Tns. [**32** 42]. From an examination of Shannon's allotype female and dissection of females of *P. noguchii* collected and reared in Peru by Hertig, the author confirms this, and he describes the spermatheca of *P. noguchii* to supplement Hertig's redescription of the female [**27** 106 ; **32** 42].

GAHAN (J. B.) & PAYNE (G. C.). **Control of** *Anopheles pseudopunctipennis* **in Mexico with DDT residual Sprays applied in Buildings.**—*Amer. J. Hyg.* **45** no. 2 pp. 123–132, 6 refs. Lancaster, Pa., 1947.

The interiors of buildings in two villages in the State of Morelos, Mexico, where the incidence of malaria is fairly high and the only important vector is *Anopheles pseudopunctipennis*, Theo., were sprayed once in April or May 1945 with an emulsified solution (or in a few cases a suspension) containing 5 per cent. DDT to leave a toxic residue, with a view to determining whether this method of controlling the Anopheline would reduce the incidence of malaria. In one village, 709 U.S. gals. spray was used on the walls and ceilings of 768 rooms at 212 mg. DDT per sq. ft., and in the other 130·5 U.S. gals. was used in 159 rooms at 190 mg. DDT per sq. ft. Two untreated villages were used as controls. In this paper, the entomological results during the mosquito season of 1945 are discussed. The information obtained in malaria surveys was too fragmentary to admit of publication at the same time. In 12 series of counts made between 15th May and 18th October of adult Anophelines resting in buildings during the afternoon, the treatments were found to have reduced the numbers by more than 99 per cent. as compared with the controls, and the numbers per building were very low. Excellent results were obtained on all types of treated surfaces, though about half the houses had adobe walls [*cf.* *R.A.E.*, B **37** 238], and the suspension was as effective as the emulsion.

The relative abundance of *Anopheles* larvae in the larger of the treated areas and its control area was determined by dipping in rice-fields. The average number of larvae per dip during a period of four months was 85 per cent. lower in the treated area than in the control area, but as the larvae were twice as numerous in the former before spraying, it is estimated that the reduction due to it was 94 per cent. The difference between actual numbers of larvae in the two areas was over 90 per cent. during the latter part of May and throughout June and then gradually decreased, but was still 70 per cent. in the fourth month after the completion of spraying [*cf.* *R.A.E.*, B **34** 128]. The high proportion of small larvae even in the untreated area showed that mortality among growing larvae is heavy, but the number of nearly mature ones found was substantially lower in the treated than the untreated village. A subsequent observation, recorded in a footnote, indicated that the single application of DDT reduced breeding for at least 11 months ; the numbers of larvae per dip in the treated area were lower by more than 70 per cent. on 18th February and 4th March 1946 than they had been on 20th February and 3rd March 1945.

HESS (A. D.) & KEENER jr. (G. G.). **The Effectiveness of DDT residual House Sprays in controlling** *Anopheles quadrimaculatus*.—*Amer. J. Hyg.* **45** no. 2 pp. 133–143, 1 fig., 8 refs. Lancaster, Pa., 1947.

The following is substantially the authors' summary. Detailed observations on the effectiveness of DDT sprays applied at 200 mg. DDT per sq. ft. to the interiors of houses to leave a toxic residue for the control of adults of *Anopheles quadrimaculatus*, Say, were made on 20 properties in eight areas near the Kentucky Reservoir between 31st May and 9th October 1945. The observations comprised periodic counts of adults in treated houses and adjacent structures and the carrying out of some 22,000 precipitin tests for human blood or fed females.

Sprays applied between 12th and 17th June resulted in almost complete elimination of *A. quadrimaculatus* from the treated houses for the rest of the season. The fact that there was a reduction in the numbers of females containing human blood among those collected from adjacent barns and other structures (chiefly henhouses and privies) indicated that migration of fed mosquitos from houses to adjacent structures occurred [*cf.* *R.A.E.*, B **29** 187]. Among fed females taken in houses during the week before spraying, in early June, the percentages that contained human blood ranged from 0 to 15·4 with an unweighted average of 5·5, whereas among females caught in barns the percentages ranged from 0 to 5·6 with an unweighted average of 2·7. Of the adults collected from ten premises, about 15 per cent. were found in the houses, 79 per cent. in the barns and 6 per cent. in other structures. A comparison of the two sets of figures indicates that about 26 per cent. of the mosquitos that had fed on man rested in the houses. Treatment of houses with DDT caused an immediate reduction ranging from 0 to over 90 in the percentage of females containing human blood in adjacent barns. The average reduction was 28 per cent. The average reduction in females containing human blood for an entire property (house and barn) was estimated to be 46 per cent.

It was concluded that, under the conditions studied, DDT treatment confined to houses might not provide adequate protection from malaria where the hazard was great, and spraying of whole premises should be considered. The data given show that spraying barns would affect more females that had fed on man than spraying the house or other structures. In practice, however, it is evident that house spraying would be preferred because of the effect against household pests other than mosquitos. The results of the precipitin tests also indicated that, on the average property studied, mosquito-proofing of the house alone, even if completely effective, could not reduce the total number of human blood meals taken by more than half. It is suggested that spraying of all buildings with DDT may be more effective in controlling malaria than house-proofing.

MILLSPAUGH (D. D.) & FULLER (H. S.). **The Occurrence of** *Trombicula deliensis* **Walch in southwestern China.**—*Amer. J. Hyg.* **45** no. 2 pp. 204–205, 2 refs. Lancaster, Pa., 1947.

The occurrence of endemic tsutsugamushi disease in certain parts of China has been suspected for some time but has been regarded as unconfirmed [*cf. R.A.E.*, B **34** 2]. Four cases, presumably among Chinese patients, were reported from Kweiyang in Kweichow Province and one from Kunming in Yunnan Province between 1940 and May 1945, and a few, apparently acquired in China, occurred among United States troops. During August 1945, mammals and birds were collected near Kunming and Kweiyang, and ectoparasites, including numerous Trombiculid larvae, were removed from them. The mites included *Trombicula deliensis*, Walch, which has not previously been recorded from China ; it was identified from rodents of three genera, a shrew (*Tupaia*) and a bird collected near Kunming. As this mite is the important vector of tsutsugamushi disease in Burma [**37** 91–92], it is thought that it probably plays a part in its transmission in south-western China.

PAUL (J. R.). **Poliomyelitis in Japan.**—*Amer. J. Hyg.* **45** no. 2 pp. 206–218, 5 figs., 27 refs. Lancaster, Pa., 1947.

MITAMURA (T.), KITAOKA (M.), WATANABE (S.) & KUSANO (N.). **Über den Infektionsmodus bei Poliomyelitis ; die Bedeutung der Mücken für die Übertragung.** [On the Mode of Infection in Poliomyelitis ; the Importance of Mosquitos for its Transmission.]—*Trans. Soc. path. jap.* **31** p. 580. Tokio, 1941.

Information on poliomyelitis in Japan collected during a recent visit is reviewed in the first paper. The disease is endemic and quite common. Of cases in children under 13 years of age, 90 per cent. were in children under five. This is a situation similar to that existing in other regions, some of them semi-tropical or tropical, where sanitary conditions are primitive, infant mortality high and poliomyelitis seldom epidemic. Poliomyelitis in Japan is much commoner in warm than in cold weather, with a sharp rise in incidence in May and June. Reference is made to recent research by Japanese workers, including the experiments described in the second paper [which has not been received at this Institute]. They showed that poliomyelitis virus of a strain received from America survived for about three weeks in some of the mosquitos (*Culex pipiens* var. *pallens*, Coq., and *Aëdes albopictus*, Skuse) fed on it. Survival was influenced by the temperatures at which the mosquitos were kept.

Veatch (E. P.), Bequaert (J. C.) & Weinman (D.). **Human Trypanosomiasis and Tsetse-flies in Liberia.**—*Amer. J. trop. Med.* **26** no. 5 suppl. 105 pp., 1 map, many refs. Baltimore, Md., 1946.

In addition to a preface by all three authors, this work comprises three parts, *viz.*, **Human Trypanosomiasis in Liberia, 1941-1944** by Veatch (pp. 5–56); **Tsetse-flies in Liberia: Distribution and Ecology; Possibilities of Control** by Bequaert (pp. 57–94); and **The Treatment of African Sleeping Sickness with two new Trivalent Arsenical Preparations (Melarsen Oxide and 70A)** by Weinman (pp. 95–105). It includes the results of field work in the Western Province of Liberia carried out from the end of 1943 to the latter part of 1944.

In the first part, details are given of the local history of the disease and of observations in Western Liberia between December 1943 and March 1944. These showed sleeping sickness to be distributed sporadically over the Province and to be of importance to public health there. The percentage infection in five different tribes ranged from 0·986 to 2·75, the over-all rate among the 32,617 persons examined being 2·2 per cent. The highest rate found in any one place was 8·09 per cent.

In the second part, the physiography, climate, vegetation, fauna and population of Liberia are described. The species of *Glossina* known to occur there are *G. palpalis*, R.-D., *G. pallicera*, Big., *G. fusca*, Wlk., *G. nigrofusca*, Newst., and *G. medicorum*, Aust. Characters are given for distinguishing the adults of all five species and the puparia of the first four. The last has been recorded from a single locality on the coast only, and its puparium has not been described. The author found all the other species and gives his own and previous records for them. *G. palpalis*, of which the typical form (as defined by Zumpt [*R.A.E.*, B **28** 141]) alone occurs in Liberia, is the only proved carrier of sleeping sickness among them. It is therefore discussed at greater length than the others. Its distribution in Africa as a whole coincides almost exactly with that of trypanosomiasis caused by *Trypanosoma gambiense*, the only form of the disease that occurs in Liberia. A search of many localities in the hinterland of the Western Province to within some 40 miles of the coast made by the author in 1943–44, which is described in detail, showed that *G. palpalis* was present on the densely wooded banks of all fair-sized rivers and was a potential menace on the trails at all river crossings. Puparia were found in the dry season only, and in classical breeding sites, *viz.*, dry, sandy, well ventilated situations on river banks, densely shaded at all hours of the day and having high atmospheric humidity assured by the close proximity to water. The breeding sites were very small and widely scattered. It appears likely that reproductive activity is successfully carried on mainly during the driest months, when enough favourable breeding sites are available. Adults appear to be more plentiful during the wet season (July to November), particularly at the river crossings. This may be because gravid females are no longer wandering away from the feeding grounds in search of breeding sites, as well as because the adult population is at its highest, following successful emergence during the preceding drier months. The increased humidity and reduced sunshine of the rainy period also enable the flies to travel farther from the river banks and thus to come nearer to villages.

Control should be directed at *G. palpalis* only. The use of insecticides, such as DDT, is not considered very practicable, though it might be tested near the limits of the fly's range. Spraying forest cover would be extremely expensive, and the foliage might prevent effective penetration. Spraying breeding areas offers somewhat more promise, but it would be necessary to apply enough spray to penetrate the litter and sand and to repeat treatment at least every fortnight for some months. Moreover, the measure would be lastingly effective only if no breeding grounds were missed. The value of hand-catching and trapping in the West African rain forest is considered dubious. Methods aimed at modifying the environment are the most likely to give results proportionate to the effort made, and of these, selective clearing is thought the most practical. Removal of the woody cover from both banks of a river for at least a quarter and preferably half a mile above and below each crossing place, and to a depth of a quarter mile would free the trails of *G. palpalis*. Clearing of the whole river course is not practicable in the continuous rain forest that covers most of the Republic. However, in the rather small savannah area of north-western Liberia, where the population is relatively dense and the sleeping-sickness rate high, it might be possible to eradicate *G. palpalis* by cutting down by sections the relatively narrow forest fringes of the rivers, starting from the crossings. Protective clothing is of limited value, as tsetses bite through even quite thick material, but leggings are a good protection. The value of repellents is discussed and found to be limited. The clearings at Fisherman Lake, from which aircraft leave for Brazil, should be extended to at least a mile in each direction from the landing pier to give effective protection against *G. palpalis*, and also to prevent it from entering the planes and being conveyed across the Atlantic [*cf.* **36** 156].

HARRIS (A. H.) & DOWN (H. A.). **Studies of the Dissemination of Cysts and Ova of human intestinal Parasites by Flies in various Localities on Guam.**—*Amer. J. trop. Med.* **26** no. 6 pp. 789–800, 2 figs., 5 refs. Baltimore, Md., 1946.

Apparatus used for trapping flies and collecting and examining their dejecta is described, and an account is given of observations made between 1st October 1945 and 1st March 1946 on the dissemination of cysts and ova of human intestinal parasites by flies in Guam, where the incidence in man of such parasites, including the two hookworms, *Ancylostoma duodenale* and *Necator americanus*, is very high. *Chrysomyia megacephala*, F., which has apparently become increasingly common in Guam of recent years, was the most conspicuous species and was prevalent in latrines. *Musca sorbens*, Wied., was also plentiful and bred in human faeces, and several other genera were represented. Flies were shown to transport viable cysts of *Endamoeba histolytica* (12 μ in diameter) to a kitchen table in a native home, and to transport hookworm ova (presumably from a poorly constructed latrine on the premises) to scraps of food on the ground, where they hatched, yielding larvae that completed the free-living part of the life-cycle to the infective filariform stage. Other intestinal parasites carried are shown in tables ; cysts of *Giardia lamblia* and ova of *Trichuris trichiura* and *Ascaris lumbricoides* were frequently found. Though no quantitative measurements were made, the authors believe that flies are of considerable significance in the spread of amoebiasis and hookworm infection in Guam, and probably also of other less important intestinal parasitic diseases. The relative importance of the different species of flies could not be evaluated, but on two occasions when very few *Chrysomyia* were included in the catch, no ova were seen, though there was evidence that the flies had had access to faecal material. This is thought to indicate that the majority of the flies, which were smaller than *Chrysomyia*, could carry in the gut and pass the relatively small cysts of protozoa but not the ova of helminths [*cf. R.A.E.*, B **38** 50–51].

KARTMAN (L.). **On the DDT Control of** *Synosternus pallidus* **Taschenberg (Siphonaptera, Pulicidae) in Dakar, Senegal, French West Africa.**—*Amer. J. trop. Med.* **26** no. 6 pp. 841–848, 2 figs., 5 refs. Baltimore, Md., 1946.

The following is substantially the author's summary. In view of the possible importance of *Synosternus pallidus*, Tasch., as a vector of plague to man in Dakar [*R.A.E.*, B **35** 170], field experiments were carried out there between

May and July 1944 to test the action of DDT deposits on adults of this flea in native huts. The experiments are described, and data are given on the immediate effect of DDT on the biting activity of *S. pallidus*.

A 5 per cent. solution of DDT in kerosene, sprayed directly on to the sandy floor or allowed to saturate the air and settle, gave a practically complete initial kill of adults of *S. pallidus*, and the deposit remained effective throughout the observation period (64 days). A dust of 10 per cent. DDT in talc, applied to the floors, gave comparable results, but seemed to produce a slightly lower initial kill and a rather more toxic deposit, though the differences were not significant. There appeared to be no appreciable advantage, as regards either immediate or lasting effect, in increasing dosages beyond 100 mg. DDT per sq. ft. Saturating the air of the huts with a pure kerosene spray gave a poor initial kill of *S. pallidus* and had no lasting effect of any significance. Host-seeking by the fleas was inhibited in ten minutes after the floor of a hut had been sprayed with 5 per cent. DDT in kerosene at about 100 mg. per sq. ft. Adults also showed typical signs of DDT poisoning in a minimum of ten minutes, and died within five hours of contact with the DDT. Larvae collected from treated floors, on which they became common a few minutes after spraying, died within seven hours.

The toxicity of DDT to *S. pallidus* under practical conditions suggests that its use may be an effective addition to established procedure in the prevention and control of flea-borne disease [*cf.* **34** 49], particularly where the species of flea concerned is highly domestic, feeds on man and is known to transmit plague or other disease from man to man.

Scott (J. A.) & Cross (J. B.). **A Laboratory Infection of the Rat with Filarial Worms.**—*Amer. J. trop. Med.* **26** no. 6 pp. 849–855, 9 refs. Baltimore, Md., 1946.

An account is given of three experiments in Texas in which infection with *Litomosoides carinii*, a filarial parasite of the cotton rat, *Sigmodon hispidus texianus*, was successfully transmitted to 15 out of 16 cotton rats, and to the only white rat exposed, by caging the infected and uninfected animals together in a moist environment into which freshly gathered grass nests of cotton rats had been introduced [*cf. R.A.E.*, B **37** 132, 139]. Details of method did not affect success. Four control white rats and 24 control cotton rats, including litters born to infected mothers, remained uninfected.

The only biting Arthropods found in the experimental cages were *Rhopalopsyllus gwyni*, Fox, which was present in moderate numbers, an undescribed species of *Atricholaelaps*, which was abundant, and *Liponyssus bacoti*, Hirst, which was rare. The relative prevalence of these three species was similar on cotton rats trapped in Galverton County, most of which were found to habour *Litomosoides*, and it therefore seemed probable that either the flea or *Atricholaelaps* was the vector, but dissection of nearly 100 fleas and over 500 *Atricholaelaps* taken from infected cotton rats or experimental cages containing them revealed no developing filarial larvae. Too few individuals of *Liponyssus bacoti* were dissected for conclusions to be drawn, but the only living microfilariae found in ectoparasites were from one of these mites. The absence of infection in the other available species appears to indicate *L. bacoti* as the vector by process of elimination, though its scarcity in the experimental cages, the failure to find it in a search through several cotton rats' nests and the rarity of its occurrence on cotton rats in nature are evidence against its ability to effect the regular transmission that occurred in the cages. On the other hand, it becomes much more distended after feeding than the *Atricholaelaps*, and it may be a more intermittent feeder tending to drop from the host after a meal. P. D. Harwood failed to infect the seven species of mosquitos found in the cotton rats' habitat in the Houston area.

BAKER (W. C.), SCUDDER (H. I.) & GUY (E. L.). **The Control of Houseflies by DDT Sprays.**—*Publ. Hlth Rep.* **62** no. 17 pp. 597–612, 2 pls., 1 fig., 3 refs. Washington, D.C., 1947.

The following is substantially the authors' summary of this account of experiments made at milk and food establishments in the United States to determine the effective duration of the toxicity of DDT deposits against houseflies [*Musca domestica*, L.], the amount of treatment necessary to obtain practical control, and the most effective method of application. DDT proved very effective not only when applied as a spray to leave a toxic deposit in farm dairies and restaurants, but also when used to impregnate strings that were hung in small food shops and as a dilute cover spray to kill adults emerging at an alley garbage station and an industrial plant. Most of the sprays were emulsions prepared from a solution of 3 lb. technical DDT in 3 U.S. quarts xylene with 6 fl. oz. Triton X-100.

In dairies, emulsion containing 2·5 per cent. DDT was used at 200 mg. DDT per sq. ft. Under poor sanitary conditions, treatment of the milking barn alone or of the outbuildings alone gave 50–70 per cent. control, which was not enough to reduce the population to a satisfactory level. A complete treatment of both barn and outbuildings usually gave satisfactory control for three months or more. DDT as an emulsified solution and as a suspension of a wettable powder gave comparable results when used under similar conditions and concentrations.

In restaurants, emulsion containing 7·5 per cent. DDT applied to the ceilings and walls of dining rooms and kitchens at 200 mg. DDT per sq. ft. gave excellent control for three months or more. On high-gloss finishes, particular caution was exercised to ensure a uniform spray pattern and to prevent coalescing of the droplets.

In small food and ice-cream shops, 40–60 ft. of cord impregnated with DDT by soaking in a 35 per cent. solution and hung as a replacement for electric-light pull cords, along the chains of suspended display shelves and from ceilings at certain accessible points gave good control when fly populations were not excessive, but was not adequate where populations were very great.

Preliminary tests in which emulsion containing 0·5 per cent. DDT was used indicated that DDT as a cover spray could give adequate control of adult flies emerging from garbage and grain wastes. Treatment at 200 mg. DDT per sq. ft. of a brick alley at the side of which refuse bins from a restaurant were kept, so that the flies bred in garbage washings between the bricks, was effective for three weeks. The treatment of sites where grain wastes accumulated at 300 mg. DDT per sq. ft. gave effective control for five weeks. When emulsion containing 2·5 per cent. DDT was applied at 200 mg. DDT per sq. ft. to leave a toxic residue on walls and ceiling near by to supplement the cover spray, a more rapid decrease in population followed and the period of effectiveness was prolonged.

MATHESON (R.). **Medical Entomology.**—2nd edn., $9\frac{1}{2}\times6\frac{1}{4}$ ins., vii+612 pp., frontis., 3 pls., 242 figs., many refs. Ithaca, N.Y., Comstock Publ. Co., Inc., 1950. Price $7·50.

Though arranged in the same way as the first [*R.A.E.*, B **21** 73], this second edition has been completely rewritten to provide a survey of the knowledge on Arthropods related to human disease available up to the end of 1948. The large amount of additional matter included makes the bibliographies appended to the various chapters an important feature of the work ; those concerned with mosquitos and the diseases they transmit occupy some 16 pages and are classified by subjects. The author index has been omitted.

Farner (D. S.), Dicke (R. J.), Sweet (G.), Isenhour (L.) & Hsiao (T. Y.). **The Distribution of Mosquitoes of medical Importance in the Pacific Area.**—*Navmed* no. 983, 13×17¼ ins., [2+] 64 pp., 26 maps, 346 refs. Washington, D.C., Navy Dep., Bur. Med. Surg., 1946.

For each of 30 species or varieties of mosquitos of medical importance occurring between Burma and Hawaii, inclusive, and between Manchuria to the north and Australia, a map showing its distribution in that area is given, together with brief notes on systematics, bionomics and relation to disease. The distribution records were compiled from the literature and from the collection data pertaining to specimens examined by the authors. The sources of the records are indicated. The mosquitos in question are *Anopheles barbirostris barbirostris*, Wulp, *A. hyrcanus nigerrimus*, Giles, *A. h. sinensis*, Wied., *A. umbrosus*, Theo., *A. aconitus*, Dön., *A. annularis*, Wulp, *A. culicifacies*, Giles, *A. farauti*, Lav., *A. jeyporiensis candidiensis*, Koidz., *A. kochi*, Dön., *A. maculatus*, Theo., *A. minimus*, Theo., including var. *flavirostris*, Ludl., *A. philippinensis*, Ludl., *A. punctulatus*, Dön., *A. subpictus*, Grassi, *A. sundaicus*, Rdnw., *A. tessellatus*, Theo., *A. vagus vagus*, Dön., *Culex pipiens pallens*, Coq., *C. fatigans*, Wied. (*quinquefasciatus*, auct.), *Mansonia annulifera*, Theo., *M. indiana*, Edw., *M. longipalpis*, Wulp, *M. uniformis*, Theo., *Aëdes togoi*, Theo., *A. aegypti*, L., *A. albopictus*, Skuse, *A. pseudoscutellaris*, Theo., *A. tongae*, Edw., and *A. hebrideus*, Edw. [which has subsequently been found to be a synonym of *A. scutellaris*, Wlk. (*R.A.E.*, B **37** 186)].

de Prada (J.). *Phlebotomus* **en Valladolid.**—*Med. colon.* **10** no. 4 pp. 269–274, 1 map, 4 figs. Madrid, 1947.

A survey of *Phlebotomus* in the Province of Valladolid, Spain, was carried out in 1945 and 1946. Captures were made by means of aspirators in fowl-houses and various agricultural buildings and by exposing white cloths in stables and other animal quarters, drainage channels and holes in trees and spraying them later with an insecticide to immobilise the sandflies on them. Locality records are given and shown on a map, and it is concluded that *Phlebotomus* occurs throughout the Province. The two species found were *P. perniciosus*, Newst., and *P. ariasi*, Tonnoir. Sandflies were taken from 20th June to 10th September and were most numerous in July and early August. They were more plentiful in 1946 than 1945, but no cases of visceral leishmaniasis were reported.

PAPERS NOTICED BY TITLE ONLY.

Day (M. F.) & Powning (R. F.). **A Study of the Processes of Digestion in certain Insects.**—*Aust. J. sci. Res.* (B) **2** no. 2 pp. 175–215, 5 pls., 5 figs., 52 refs. Melbourne, 1949. [See *R.A.E.*, A **38** 165.]

ten Houten (J. G.) & Kraak (M.). **A vertical Spraying Apparatus for the Laboratory Evaluation of all Types of liquid Pest Control Materials.**—*Ann. appl. Biol.* **36** no. 3 pp. 394–405, 1 pl., 5 figs., 5 refs. London, 1949. [See *R.A.E.*, A **38** 150.]

Lidov (R. E.), Knous (H.) & Beckwith (C.). **Emulsifiable Concentrates of Chlordane.**—*Soap & sanit. Chem.* **24** no. 3 pp. 137–139. New York, N. Y., 1948. [See *R.A.E.*, A **38** 153.]

D'ALESSANDRO (G.), BURGIO (G. R.) & MARIANI (M.). **Commento all'attuale recrudescenza della leishmaniosi viscerale a Palermo. Prospettive della lotta contro i flebotomi a mezzo del D.D.T.** [A Note on the present Recrudescence of Visceral Leishmaniasis in Palermo. Prospects of controlling *Phlebotomus* by Means of DDT.]—*Rif. med.* 1947 no. 21–22 repr. 12 pp., 3 figs. Naples, 1947.

An outbreak of visceral leishmaniasis occurred in Palermo in 1944 and 1945, when more than twice the usual number of cases were reported. There had been no increase in the number of dogs in the city, and though *Phlebotomus* was very common, *P. perniciosus*, Newst., the usual vector of the disease in the Mediterranean area, could not be found, more than 3,000 sandflies taken over three years all proving to be *P. papatasi*, Scop. [*cf. R.A.E.*, B **36** 108]. The sandfly population began to increase in March and reached a sharp peak in late August, but the number of cases declined throughout this period and did not increase again until October, when sandflies were becoming scarce. Despite this and the fact that *P. papatasi* does not transmit visceral leishmaniasis elsewhere, it is considered to have been the local vector, and the discrepancy between its frequency and the seasonal distribution of cases is explained on the hypothesis of a prolonged incubation period for the disease.

Since female sandflies rest on ceilings and reach their sleeping human hosts by a series of short flights down the walls, the possibility of protecting sleepers by fastening broad strips of paper bearing deposits of DDT horizontally along the parts of the walls by the beds was tested. Paper of the newsprint type was treated with a 5 per cent. solution of DDT in kerosene at 20 cc. per sq. metre, allowed to dry and put up in four bedrooms on 14th September. The *Phlebotomus* population was falling at the time, but sandflies were taken in four untreated control bedrooms until the end of October. None was taken in the treated rooms after 16th September. The treatment also gave complete protection from *Aëdes aegypti*, L., which was increasing in numbers at the time.

TRAVASSOS SANTOS DIAS (J. A.). **Mais dois Ixodídeos do género** *Amblyomma* **para a fauna de Moçambique,** *A. theileri* **n. sp. e** *A. tholloni* **Neumann, 1899.** [Two more Ixodids of the Genus *Amblyomma* for the Fauna of Portuguese East Africa.]—15 pp., 5 figs., refs. Lourenço Marques, Soc. Estud. Colón. Moçambique [1947].

The author gives a list of the six species of *Amblyomma* hitherto known from Portuguese East Africa, and notes on their hosts and distribution, with special reference to Africa. The two that are of importance in the Colony as pests of cattle are *A. variegatum*, F., and *A. hebraeum*, Koch. An adult male described as *A. theileri*, sp. n., was taken from an ox in the district of Gaza in 1947, and another species (*A. tholloni*, Neum.), the adults of which are described, was taken on elephant in the same year. Keys to the males and females of all eight species are given.

SPENCER (W. T.). **Sarcoptic Swine Mange Control Tests with Chlordane.**—*J. Amer. vet. med. Ass.* **113** no. 857 p. 153, 2 figs. Chicago, Ill., 1948.

Sarcoptic mange of pigs [caused by *Sarcoptes suis*, Gerl.] has become widely distributed in all the parts of the United States in which pigs are extensively reared and considerably more than half the herds in Nebraska and Iowa are thought to be infested. Resulting irritation causes stunted growth, and meat from infested animals is of poor quality. The effectiveness of chlordan against the mite was tested in Nebraska on more than 800 infested pigs, many of them showing extensive and advanced lesions. A spray containing 0·25 per cent.

chlordan as an emulsified solution was applied at 1–2 U.S. quarts per head with 50–250 lb. pressure. Treated animals were relieved of irritation within a few hours, and all showed a marked improvement in general condition after one week. In two weeks, the heavy scabs were loose and scaling off, the skin underneath was pink and pliable and new hair was developing. No mites were found in skin scrapings taken 17 and 28 days after treatment. No systemic disturbance or skin irritation due to treatment was noted in any of the animals at any time.

Muma (M. H.) & Spencer (W. T.). **Dog Mange Control Tests with Chlorinated Chemicals.**—*J. Amer. vet. med. Ass.* **113** no. 857 pp. 167–168, 1 fig., 1 ref. Chicago, Ill., 1948.

In the experiments reported, all of which were made in Nebraska, 12 dogs heavily infested with *Sarcoptes canis*, Gerl., and moderately infested with *Demodex canis*, Leydig, were treated with a suspension containing 0·25 per cent. γ BHC (benzene hexachloride), 11 dogs similarly infested were treated with an emulsion containing 0·08 per cent. heptaklor [1(or 3a),4,5,6,7,8,8-heptachlor-4:7-methano-3a,4,7,7a-tetrahydroindene] and five dogs, of which all were heavily infested with *Sarcoptes* and three were also infested with *Demodex*, were treated with an emulsion containing 0·25 per cent. chlordan. All treatments were applied by dipping the animals in the liquid for 30–60 seconds with at least two complete immersions. The dip was heated to a temperature of 100–110°F. Exceptionally large or heavy demodectic lesions were scrubbed with a firm-bristled brush while the dog was in the bath. Dogs treated with chlordan were allowed to run with untreated ones; the others were partly isolated. The condition of all the animals was greatly improved 10–14 days after treatment; lesions were healing, rough skin was scaling off and hair was growing. After three weeks, most of the lesions were healed, the skin appeared healthy and hair had grown except at the sites of the worst infestations with *Demodex*. One dog with a large lesion of demodectic mange had a new, small, active lesion at one side of the healed area. This animal had been treated with γ BHC. One dog that had been heavily infested with both *Sarcoptes* and *Demodex* before being treated with chlordan also had several small demodectic lesions three weeks after dipping. None of the animals showed any ill effects from the treatments. These preliminary tests indicate that sarcoptic mange and many cases of demodectic mange of dogs can be controlled with one or more applications of the treatments indicated.

House (H. L.) & Patton (R. L.). **Nutritional Studies with *Blattella germanica* (L.) reared under aseptic Conditions. I. Equipment and Technique.**—*Canad. Ent.* **81** no. 4 pp. 94–100, 2 figs., 7 refs. Guelph, Ont., 1949.

House (H. L.). **II. A chemically defined Diet.**—*T.c.* no. 5 pp. 105–112, 1 fig., 22 refs.

House (H. L.). **III. Five essential Amino Acids.**—*T.c.* no. 6 pp. 133–139, 2 figs., 18 refs.

The following are virtually the authors' summaries of these three parts. Equipment and methods are described whereby nymphs of *Blattella germanica*, L., were reared through their entire life-cycle in an aseptic environment. A description is given of the equipment used for feeding, and for anaesthetising and manipulating the transfer of nymphs for weighing. During the growth period of the insects, provision was made to evaluate the effects of nutritional factors by weighing each individual at frequent intervals. The effectiveness of the technique is indicated by a contamination factor of less than 1 per cent. in 300 trials.

Diets were formulated for the nutritional studies. Among these was a chemically defined diet consisting of known quantities of amino acids, carbohydrates, vitamins, fats, sterols and minerals. Nymphs reared on this diet under aseptic conditions reached maturity and reproduced. The growth on the synthetic diet was approximately two-thirds of that recorded on a diet of natural substances. Nevertheless, it is considered that the diet is particularly well suited for studies on the nutritional requirements of *B. germanica*.

Experiments were carried out under aseptic conditions with amino acids to determine the nutritional importance of valine, tryptophane, cystine, glycine, arginine, histidine and methionine. Of these, it was shown that valine, tryptophane, histidine and probably arginine are essential for normal growth. Cystine appears to be essential for development. Neither growth nor development is affected when either glycine or methionine is omitted from the diet.

HERTIG (M.). **The Type of *Phlebotomus mascittii* Grassi (Diptera, Psychodidae).**—*Bull. ent. Res.* **40** pt. 4 pp. 453–457, 3 figs., 14 refs. London, 1950.

Grassi described *Phlebotomus mascittii* in 1908 from adults of both sexes reared from larvae collected in a cellar in Rome. All his material appears to have been lost except a single cotype male that was redescribed by Newstead. Newstead stated that it was difficult to distinguish from *P. perniciosus*, Newst., but opinions have since differed as to whether *P. mascittii* is identical with this species or with *P. larroussei*, Lngn. & Nitzu. [*R.A.E.*, B **33** 115]. In 1948, Saccà and the author found *P. perniciosus* in the street containing the house from which Grassi had obtained *P. mascittii*, but Sacca had previously taken *P. larroussei* in the neighbourhood and considered that, on the basis of wing venation, it was synonymous with *P. mascittii*.

Later in the year, the author examined the cotype male (which he designates the lectotype) and he confirms the substantial accuracy of Newstead's description and drawings, except for the genital pump. The form of the aedeagus alone allows of no possible confusion with *P. perniciosus*, of which an adequate series of Italian specimens was available for comparison. The question of the distinguishing characters of the female is associated with that of the identity of *P. mascittii* and *P. larroussei*, for which there is strong published evidence involving both males and females. It includes the character of the wing venation, which seems to be constant in both sexes, the general agreement in the male genitalia and the fact that one of Saccà's specimens was taken within a few hundred yards of the type locality and the others in the same city. In the absence of any contrary evidence there is no reason to doubt the soundness of the view shared by Saccà and Parrot that *P. larroussei* is a synonym of *P. mascittii*.

EVANS (G. O.). **Studies on the Bionomics of the Sheep Ked, *Melophagus ovinus*, L., in west Wales.**—*Bull. ent. Res.* **40** pt. 4 pp. 459–478, 10 figs., 13 refs. London, 1950.

The following is almost entirely based on the author's summary. A method is described for studying the life-cycle of *Melophagus ovinus*, L. on sheep. It consists of isolating a part of the fleece 4 inches square by clipping a strip of wool round the patch to within ⅛ or ¼ in. of the skin and sticking a sleeve to the clipped strip to form a cage, which is closed by means of a zip-fastener. The cage has to be reattached after seven weeks, as a gap forms in that time between it and the skin owing to the growth of the wool. The life-cycle of keds in the cages was shown to be similar to that of others living free on the sheep [*cf.* also *R.A.E.*, B **30** 31–32, etc.]. The males require 10–11 days to become sexually mature, and though a female can pair 16 hours after it emerges, the sperms are then stored until the ovum is ready to be fertilised. Consequently the female deposits its first pupa about 13 days after emergence, whereas subsequent ones are deposited at intervals of 7–8 days. The pupal stage covers 20–26 days (an average of 22·5 days for 28 observations).

An investigation made in 1946 of the periodic fluctuations in the ked populations on a flock of Welsh sheep showed that the degree of infestation is affected by the transfer of keds between the sheep. Before lambing, keds are transferred from hoggs (yearlings) to ewes 2–3 years old, and after lambing, from ewes to lambs. Infestation of ewes and hoggs is highest at lambing time, after which it falls rapidly. The infestation on lambs increases to a peak at shearing time, when it is much greater than on the older sheep. Most adult keds and pupae are removed with the fleece at shearing, and most surviving adults are killed at dipping. Re-infestation results from transfer of keds from infested sheep in contact with the dipped flock, and, in the case of some types of dip, from pupae left in the fleece. Keds disappear from the fleece through being eaten by the sheep or by insectivorous birds and through natural death. Transfer from sheep to sheep by contact occurs readily when the ked is on the surface of the fleece. Vertical migration in the fleece is controlled by temperature and is not influenced by light.

The distribution of pupae and adults over the body of lambs, hoggs and ewes is given. The position of attachment of the pupae on the wool fibres is controlled by the depth of the fleece, deposition occurring at a point where the temperature is suitable for development. Open-fleeced sheep are more susceptible to infestation than tight-fleeced sheep, and young sheep than older ones. In a flock, the higher infestation of hoggs compared with older ewes may be due to larger numbers being left after dipping when they were lambs, if the dip used was arsenical. The heavier infestation of lambs after dipping should not occur when the use of DDT and benzene hexachloride is general, as both eradicate infestations.

TOMS (B. A.). **Mosquito Control : an Investigation of natural Surface Films in relation to the Spreading of larvicidal Oils upon Water.**—*Bull. ent. Res.* **40** pt. 4 pp. 503–510, 1 fig., 5 refs. London, 1950.

Methods of assessing the spreading qualities of oils to be used as mosquito larvicides are unsatisfactory if they do not take into account the nature of the water to be oiled. The behaviour of an oil is greatly affected by the natural films on the water [*cf. R.A.E.*, B **31** 216 ; **34** 25] in the different places where it is used or at different times in the same place. Because of this and as the spreading power of an oil can be increased by adding quite small amounts of suitable substances, it would be advantageous to be able to arrange before the beginning of distribution that an oil has optimum spreading properties in relation to prevailing conditions. Film pressure (the measure of the resistance offered to the spreading of oil) can be easily determined in the field by the use of standard spreading liquids [*cf.* **34** 25–26]. An account is given of an attempt made in the Gold Coast in 1944 to estimate the optimum spreading properties for an oil for use in a particular district by making tests on the water at many different places.

The resistance of natural films on various types of water was measured at the beginning of the dry season by using series of standard solutions of known and constant spreading pressures. It was found that films were of two types distinguished as " uniform " and " non-uniform " according to the observed variation of the film pressure at a single site. Substantially uniform films were found at all sites where the surface of the water appeared clean, and non-uniform films were frequently found where a surface scum was clearly visible. The results indicated that an oil with spreading pressure of about 30 dynes per cm. would have adequate spreading powers for use as a larvicide at the time and in the region concerned. Very large values for film pressure were quite often obtained, usually where the water surface was badly fouled with scum, but the advantage to be expected from using an oil with a spreading pressure substantially higher than 30 dynes per cm. would be relatively small. Oils with a spreading pressure of 25–30 dynes per cm. were observed to spread adequately when deposited as fine sprays on the water at some of the sites visited, and it was not uncommon for a continuous film to be formed where only a light deposit of droplets had fallen.

Lewis (E. A.). **Tsetse Flies carried by Railway Trains in Kenya Colony.**—*Bull. ent. Res.* **40** pt. 4 pp. 511–531, 2 maps, 1 graph, 14 refs. London, 1950.

The danger of tsetse flies being carried from infested country to uninfested stock-rearing areas in Kenya by railway trains running from Mombasa to Nairobi has long been realised [*R.A.E.*, B **30** 120; **31** 91]. The flies are commonly seen to enter passenger carriages at stations. There is a consequent reluctance on the part of settlers to develop to its full capacity land affected by this dispersal. The country through which the trains travel is described, and an account is given of a survey of the fly distribution on the route. Apart from *Glossina austeni*, Newst., which is rarely if ever attracted away from the dense forest, the species present were *G. longipennis*, Corti, *G. pallidipes*, Aust., and *G. brevipalpis*, Newst., all of which are vectors of animal trypanosomiasis.

Totals of flies of these three species collected in a preliminary survey in 1945 and in monthly surveys between July 1946 and December 1947 by teams of fly boys from passenger trains between Emali and Sultan Hamud railway stations (about 17 and 25 miles, respectively, outside the fly belt towards Nairobi) and from goods trains at the two stations, are shown in tables. The total number taken in the latter survey was 37,982, of which 5,671 were collected from inside passenger trains, and 32,311 on the outer surfaces and undercarriages of goods trucks. The average per goods train at Sultan Hamud was 18–19 and the maximum 227. The average at Emali was lower, but this was probably because the stop was too short for a thorough search. There was only one passenger train per day from Mombasa to Nairobi but there were many goods trains and there were several that passed at night and others that did not stop at Emali in addition to those examined. Many tsetses not collected by the teams were carried up-country even as far as Nairobi, 101 miles from the fly belt. It is estimated that no less than 7,873 flies are carried annually on up-trains that pass by day beyond Sultan Hamud station. *G. longipennis* comprised the vast majority of the flies caught. It was attracted to day trains as readily as to night ones, and females were nearly as common on the trains as males [*cf.* **30** 120].

The part played by motor traffic in the dispersal of *Glossina* was also examined in 1945. The largest number of flies was found on lorries travelling in convoy. Convoys of 10–64 vehicles had 4–33 flies, mostly under the tarpaulin covers. Catching of flies on road vehicles was discontinued when military convoys ceased, as the results no longer seemed to justify it.

The repeated occurrence of animal trypanosomiasis on farms along the railway line shows the importance of fly dispersal by trains. The outbreaks have varied in frequency and severity and appear to coincide with the degree and extent of fly dispersal. Moreover, laboratory experiments at Kabete showed that each of the three species of *Glossina* concerned can transmit *Trypanosoma congolense*, *T. vivax* and *T. brucei*, each of which will cause serious and often fatal disease in some class of domestic animal. Bush-clearing on stock farms outside the fly belt will not protect the cattle from infection carried by flies brought by trains, but it discourages wide dispersal by the tsetses carried beyond their natural habitat. The removal of woody vegetation along the whole of that part of the railway line that runs through the fly belt is not practicable, but bush-clearing in specified localities of fly concentration in the infested country is recommended as a measure to reduce the numbers now attracted to trains. The removal of flies from trains is an essential supplementary, if not an initial, step. Spraying the trains is considered a desirable method, but, so far, no insecticide sufficiently cheap has been found nor has a suitable spraying apparatus been devised.

ULLYETT (G. C.). **Pupation Habits of Sheep Blowflies in relation to Parasitism by *Mormoniella vitripennis*, Wlk. (Hym., Pteromalid.).**—*Bull. ent. Res.* **40** pt. 4 pp. 533–537. London, 1950.

The pupation habits of the three main species of sheep blowflies that develop in carrion in South Africa, namely *Lucilia sericata*, Mg. [of which the author considers *L. cuprina*, Wied., to be a form (*R.A.E.*, B **35** 100)], *Chrysomyia chloropyga*, Wied., and *C. albiceps*, Wied., were studied in relation to parasitism by *Mormoniella vitripennis*, Wlk. When fully grown larvae were placed on sand in a glass-covered tray and kept at 80°F. until puparia had been formed, 98·87 per cent. of the puparia of *Lucilia* were formed in the sand and would have been safe from attack by the Pteromalid, whereas 57 per cent. of those of *C. chloropyga* [*cf.* **32** 58] and 98·73 per cent. of those of *C. albiceps* were on the surface. These results were confirmed when extra choice of sites was offered by rearing the larvae on meat in galvanized iron dishes placed on sand. In each experiment, the protection sought increased with the attractiveness of the species to the parasite, which has been shown to be greatest in *L. sericata* and least in *C. albiceps*. The preference of *M. vitripennis* for *Lucilia* is thus largely offset and the unexpectedly large populations of the latter in the field as compared with *C. albiceps* are explained. The phenomenon is a disadvantage in the natural control of primary sheep blowflies, as *C. albiceps*, a secondary fly, is an important predator of *Lucilia* [*cf.* **33** 8].

MUMA (M. H.) & HIXSON (E.). **Effects of Weather, Sanitation and Chlorinated Chemical Residues on House and Stable Fly Populations on Nebraska Farms.** —*J. econ. Ent.* **42** no. 2 pp. 231–238, 5 figs., 21 refs. Menasha, Wis., 1949.

Experiments were carried out in Nebraska in 1947 and 1948 to compare the effectiveness of deposits of DDT, methoxy-DDT (methoxychlor), DDD (dichlordiphenyldichlorethane), chlorinated camphene [toxaphene] and chlordan for the control of *Musca domestica*, L., and *Stomoxys calcitrans*, L., in milk barns, to study the effect of sanitary practices on the fly populations in the treated barns and to compare the effectiveness of treating barns (spraying the interior of the entire barn that houses the milking room) and treating complete premises (spraying all barns, sheds, windbreaks, feeding racks, trees, shrubs and fences on the farm).

Literature on the importance of sanitation in the control of *M. domestica* and *S. calcitrans* is reviewed. A sanitary index was established on the basis of frequent cleaning of the floor and gutter of the milking room and loafing shed, frequent removal and spreading of manure piles, use of isolated frequently cleaned sheds and buildings as regular quarters for farm animals, and destruction or removal of old hay and straw stacks, piles of bedding, silage, etc. Farms using all four of these measures were rated as excellent and those using three, two or one as good, fair and poor, respectively. Populations of *M. domestica* were increased by poor sanitation, high temperatures or moderate to heavy rains. Favourable weather for breeding and development and the presence of adequate breeding media masked the effect of insecticidal deposits and reduced their usefulness. *S. calcitrans* was similarly affected by weather, but did not appear to be strongly influenced by sanitation. Wind had very noticeable temporary effects but no striking general effect.

DDT, DDD, methoxy-DDT and chlordan were all used as 2 per cent. water suspensions and toxaphene as a 2 per cent. water emulsion. Walls and ceilings were wetted almost to run-off. The results for both seasons are given in tables. Under comparable practical conditions, deposits from all five sprays seemed to be about equally effective. *M. domestica* was maintained at a low level for some 4–6 weeks. The apparent reduction of *S. calcitrans* lasted less than two weeks in 1947 and 2–3 weeks in 1948 and it is not certain that it was entirely attributable to the sprays. Treating complete premises, instead of barns only, appeared to have no significant additional influence on the number of either species entering the milking barns, but this does not imply that it would not significantly improve the reduction in fly populations on the farm as a whole

WOODRUFF (N.) & TURNER (N.). **Effect of Dispersing and Spreading Agents on Toxicity of DDT Spray Powders.**—*J. econ. Ent.* **42** no. 2 pp. 243–248, 4 figs., 14 refs. Menasha, Wis., 1949.

It was reported in 1944 that the addition of wetting agents to DDT sprays did not improve and in many cases reduced their toxicity to insects, but as their use offers many advantages, a further study of the question was made in Connecticut. The main factors thought likely to be involved are a reduction in coverage and excessive thinness of the film produced ; and tests by the authors in 1948 showed that a given amount of DDT was more toxic to house-flies [*Musca domestica*, L.] when applied to part of a surface than when spread over the whole of it. Reduction in tenacity is another possible factor.

In the experiments described in this paper, the sprays were suspensions of powders containing 50 per cent. DDT with diatomaceous earth or clay as the diluent, and two dispersing agents, chosen because they do not lower the surface tension of the water and therefore should not affect droplet size, were used as well as two wetting agents. The wetting agents were Tritox X-100 (polyethylene glycol phenylisooctyl ether) and Igepon-T-Powder (a sodium salt of sulphonated ethylmethyl oleylamide), and the dispersing agents were Darvan 1 and Darvan 2 (polymerised sodium salts of alkylaryl sulphonic acids). In the laboratory, the sprays were applied to glass slides, and the deposits were tested for toxicity to house-flies. The addition of 0·25–2 per cent. of Igepon-T-Powder or either dispersing agent to a suspension containing 0·0625 per cent. DDT reduced its toxicity progressively as the amount of additive increased, but the toxicity of sprays containing 0·125–0·0156 per cent. DDT was not appreciably affected by the inclusion of much smaller amounts of Triton X-100 or either dispersing agent (equivalent to 2 per cent. of the DDT or 1 per cent. of the spray powder) either when they were mixed with the powder or added after the latter was in suspension.

In tests of the effect of the dispersing agents on tenacity, in all of which the sprays contained 0·5 per cent. DDT, glass slides that had been weighed, sprayed, dried and re-weighed for actual deposit were washed in cold water and weighed again. In the first series of tests the dispersing agents were added to the sprays at concentrations of 0·5–2 per cent. Unlike wetting agents [*cf. R.A.E.*, B **38** 91], the dispersing agents increased the deposit as the concentration was increased, though they reduced tenacity greatly. However, mortality of flies exposed to the smallest of the final deposits was high, indicating that these must be substantially pure DDT, the dispersing agent and diluent (diatomaceous earth) washing off independently. When 1 per cent. dispersing agent was added to the spray powder (DDT and clay), the deposits were not affected, and although tenacity was slightly reduced, this would be offset by the high toxicity of the residue.

A field test against a flea-beetle on potato confirmed the laboratory conclusion that the addition of small amounts of a wetting or dispersing agent to DDT powders does not reduce their toxicity.

EDDY (G. W.) & GRAHAM (C. H.). **Tests to control Horn Flies with new Insecticides.**—*J. econ. Ent.* **42** no. 2 pp. 265–268. Menasha, Wis., 1949.

In the summer of 1947, wettable-powder suspensions of DDT, methoxy-DDT (methoxychlor), DDD (dichlordiphenyldichlorethane), chlordan and toxaphene, and emulsified solutions of DDT and methoxy-DDT were compared against *Siphona irritans*, L., in laboratory and semi-field tests in Texas. When small wire-screen cages were dipped in wettable-powder suspensions containing 0·5 per cent. of the insecticide and 20 flies were introduced 24 hours later, methoxy-DDT caused complete knockdown in 5 minutes, DDT in 8, DDD in 17, chlordan in 53 and toxaphene in 73. When flies were introduced two months after dipping, methoxy-DDT caused complete knockdown in 12 minutes, DDT in 62, DDD in 152, toxaphene in 248 and chlordan in 360–720. When the emulsified solutions were used, methoxy-DDT was as effective as the powder, but DDT was less effective. When cattle were sprayed with the insecticides at the same concentration and caged with 100 flies each, the order in which the insecticides caused knockdown was the same as in the small-scale tests, but all except chlordan took longer. None of them appeared to be repellent. In semi-field tests in which sprayed animals were caged with test flies once a week, the five materials as 0·5 per cent. suspensions all gave complete kill after one week, and the two best, DDT and toxaphene, gave 100 and 98·5 per cent. kill, respectively, after two weeks and 78·5 and 80 per cent. after three weeks. The emulsified solutions of DDT and methoxy-DDT were as effective as the wettable powders after one week, but lost their toxicity more rapidly. In a further test, DDT as a 1·5, 0·5 and 0·25 per cent. suspension gave 100, 100 and 98 per cent. kill after three weeks and 94, 59 and 51 per cent. after four weeks. The emulsified solution again proved less satisfactory. In comparative tests with different breeds of cattle, DDT retained its effectiveness much better on Herefords than on Jerseys or Brahmans. The difference between the last two was not great.

TASHIRO (H.) & SCHWARDT (H. H.). **Biology of the major Species of Horse Flies of central New York.**—*J. econ. Ent.* **42** no. 2 pp. 269–272, 3 figs., 3 refs. Menasha, Wis., 1949.

Investigations on Tabanids in New York [*cf. R.A.E.*, B **37** 190] were continued in 1948, when attention was directed primarily to species of *Tabanus* as they are more important pests of dairy cattle than *Chrysops*. Information on seasonal abundance was obtained by catching flies from a tethered cow with a sweeping net having a truncated celluloid cone fastened inside it so that it could be used continuously without emptying. The three major species in the central area were *T. lasiophthalmus*, Macq., *T. quinquevittatus*, Wied. (with which Philip [**38** 40] has found *T. vicarius*, Wlk. [and *T. costalis*, Wied.] to be synonymous), and *T. sulcifrons*, Macq. *T. lasiophthalmus* was seen during the first week of June, reached its maximum abundance during the second week and had practically disappeared by the first week of July, when it was replaced by *T. quinquevittatus*. The latter was much the most important and abundant species and had the longest season. *T. sulcifrons* largely replaced it in August, and became as abundant as *T. lasiophthalmus* had been in June. *T. lineola*, F., with its variety *scutellaris*, Wlk., was present during much of the season, but in small numbers, and *T. pumilus*, Macq., was relatively abundant in early July but of minor importance.

Fly activity was practically negligible below 72°F., usually heavy regardless of humidity between 72 and 90° and retarded above 90°. When temperatures were suitable, wind movement appeared to interrupt activity more than any other factor.

Engorgement occupied 1·5–20 minutes with an average of about 5 minutes. To catch fully engorged flies, celluloid cages were placed over them after feeding had begun and clipped to the cow's hair. Weighing of females of *T. quinquevittatus* and *T. sulcifrons* indicated that they take averages of 71 mg. and 344 mg. blood, respectively. With the populations observed (90 and 40 flies per hour, respectively, for 8–9 hours a day on one animal), flies of the former species could take 53 cc. blood per animal per day and those of the latter 115 cc. This takes no account of the activities of minor species or the blood that drips from the wounds.

An apparatus for collecting larvae from sod on a fairly large scale was devised on the principle of the one used in the previous year [**37** 190]. The rack measured 6 × 12 ft. and was divided into eight squares and supported over sheet metal funnels each measuring 3 × 3 ft. at the top. The sods on the rack were covered with cold-frame sashes to keep out the rain, and heated by infra-red lamps under the sashes. By using these, and a tarpaulin cover on cool nights, the temperature over the sod was maintained at 90–100°F. Under these conditions, a 3-in. layer of sod could be dried in 5–7 days. Samples from the edge of a small stream, a particularly suitable habitat, contained 14–120 larvae per sq. yard, and 187 larvae, including both *Chrysops* and *Tabanus*, were found in 4 sq. yards of sod from a perpetually saturated area under trees but without standing water. A systematic survey of sod collections in one pasture showed a distinct correlation between the moisture-content of the soil and the incidence of larvae of *T. quinquevittatus*. They occurred in moist but not wet soil, and the available area of suitable sod was extensive. This probably accounts for the abundance of the species. In the pasture concerned, there was about 2·25 acres of suitable sod from which it was estimated that 43,560 females could emerge. No adults of *T. lasiophthalmus* or *T. sulcifrons* have been reared from larvae found in nature in New York, but larvae appearing to belong to these two species have been found in saturated soil.

LAAKE (E. W.). **Livestock Parasite Control Investigations and Demonstrations in Brazil.**—*J. econ. Ent.* **42** no. 2 pp. 276–280. Menasha, Wis., 1949.

The author visited Brazil in April and May (dry season) 1948 to investigate and give demonstrations on the control of pests of dairy cattle. The work was done at three farms in the State of Rio de Janeiro and two in Minas Gerais. At least 90 per cent. of the pests seen were ticks (mostly *Boophilus annulatus microplus*, Can.) and larvae of *Dermatobia hominis*, Say, both of which were extremely abundant, although arsenious-oxide dips were being used. These were neither killing all ticks present nor preventing immediate reinfestation, and they were without effect on *Dermatobia*. They were moreover injuring the cattle. Ticks are most plentiful in the dry season, but *Dermatobia* larvae reach their greatest abundance during the wet season. The cattle on the two farms in Minas Gerais were also infested by *Haematopinus tuberculatus*, Burm., in spite of the arsenical dips. House-flies [*Musca domestica*, L.] were abundant on two farms, and stable flies [*Stomoxys calcitrans*, L.] were present everywhere but only in moderate numbers. There were few or no Tabanids and rather few cases of infestation by screw-worms [*Callitroga hominivorax*, Coq.] during the tests, but these are more serious during the wet season. Horn-flies [*Siphona irritans*, L.] were also seen.

The preparations tried for control comprised emulsion concentrates containing DDT or toxaphene, BHC (benzene hexachloride containing 12–13 per cent. γ isomer) as a wettable powder, and cubé powder containing 4·7 per cent. rotenone. Cattle heavily infested by *Boophilus* were sprayed with 0·25, 0·5 or 0·75 per cent. toxaphene or mixtures containing 0·25 per cent. BHC with 0·25 or 0·5 per cent. DDT. All sprays gave complete control after one week. Toxaphene maintained it after two weeks at all strengths and after three weeks at 0·5 per cent. At the end of four weeks, the three concentrations were giving 91, 88·2 and 85·2 per cent. reduction, respectively. After two, three and four weeks, the mixture of BHC and 0·5 per cent. DDT was giving 97·6, 82·5 and 49·3 per cent. reduction, and the weaker one less. The control animals with which comparison was made were dipped every 15 days in the arsenical bath throughout the test period. No visible injury to personnel or animals was caused by the BHC-DDT mixtures or the toxaphene. Dipping in 0·53 per cent. toxaphene freed heavily infested animals from all stages of the tick within 48–72 hours and protected them from reinfestation for about four weeks. Dipping in 0·5 per cent. DDT did not kill all the partly engorged ticks present, nor did it protect animals from reinfestation for more than two weeks.

Barns and stalls sprayed with 0·5 per cent. toxaphene or 5 per cent. DDT were quickly freed of heavy populations of *Musca domestica* and kept free from reinfestation for six weeks, after which observations were discontinued. One treatment with toxaphene or the mixtures of DDT and BHC in the formulations and concentrations used against ticks eradicated *H. tuberculatus*, whereas cubé suspensions killed only the crawling stages. Repeated arsenical treatments were ineffective. Suspensions containing 4–16 lb. cubé powder per 100 U.S. gals. water applied at close range at 400 lb. pressure and a wash containing 20 lb. cubé powder per 100 U.S. gals. rubbed in with a stiff brush were ineffective against the deeply encysted second-stage and third-stage larvae of *D. hominis*, and the suspension used for the wash also failed to kill all the large larvae when injected into the cysts, though it apparently caused some larvae to disappear from them within a week of treatment. The toxaphene and mixtures of DDT and BHC had no effect on encysted larvae.

Incidental observations in Costa Rica, Panama and Venezuela revealed *Dermatobia* infestations in almost every herd of cattle inspected, and relatively few animals were entirely free from them. In all these countries, *Dermatobia* and *Boophilus* were by far the most serious and damaging external parasites of cattle, but *C. hominivorax* was of importance in Venezuela in late May.

Granett (P.), Haynes (H. L.), Connola (D. P.), Bowery (T. G.) & Barber (G. W.). **Two Butoxypolypropylene Glycol Compounds as Fly Repellents for Livestock.**—*J. econ. Ent.* **42** no. 2 pp. 281–286, 3 refs. Menasha, Wis., 1949.

Of some polyalkylene glycol derivatives tested for repellency to *Musca domestica*, L., two butoxypolypropylene glycol compounds showed promise. They have approximate molecular weights of 400 and 800 and are referred to below as B400 and B800, respectively. Their characteristics are given. In preliminary laboratory tests, B800 applied in alcohol to baited blotting paper reduced the feeding of house-flies by 90–100 per cent. for four days and 80–90 per cent. for 13 days, as compared with feeding on baited, unsprayed paper. By comparison, Indalone (n-butyl mesityl oxide oxalate) reduced feeding by 68 per cent. at the end of four days. In the same type of test continued for six days, B400, B800 and Indalone reduced feeding by 91, 96 and 86 per cent., respectively.

In tests carried out on cattle in New Jersey in 1945 by the half-cow method [*cf.* *R.A.E.*, B **37** 169], B800 at 5 and 20 per cent. reduced the number of flies (*Stomoxys calcitrans*, L., and *Siphona irritans*, L.) by about 80 per cent. for six hours. Tested by the same method in 1946, B800 appeared to give nearly 60 per cent. protection when used at 10 per cent. in oil and was 10 per cent. less effective when applied in aqueous emulsion. On the other hand, B400 gave over 70 per cent. protection in emulsion and nearly 50 per cent. when used in oil. In 1948, the whole-cow method was used, and the concentration was 10 per cent. in all cases. B400 and B800 in oil and B400 in water emulsion with two different emulsifiers gave 75·7, 61, 64·8 and 60 per cent. protection, respectively, on the day of treatment and 7·3, 46·7, 27·4 and 28 on the next day. The corresponding figures for Indalone in oil were 47·2 and 0. In field tests made by S. T. Creighton by the whole-cow method in Florida in 1945, 1946 and 1947, the full results of which are not given, B400 and B800 both protected dairy cattle from *Stomoxys* and *Siphona* for several days. Preliminary field tests on horses in New Jersey in 1948 in which the compounds were used at 10 per cent. in oil, indicated that they were also repellent to *Tabanus* spp., the best results in this case being given by B400 (97 per cent. control of *Tabanus* and *Stomoxys*).

B800 was shown in Peet-Grady tests to be a synergist for pyrethrins. Without it, 100 mg. pyrethrins per 100 cc. gave 98·3 per cent. knockdown of *Musca domestica* in 10 minutes and 57·5 per cent. kill in 24 hours, whereas with the addition of 10 per cent. B800, 50 mg. pyrethrins gave 96·9 per cent. knockdown and 78·7 per cent. kill. B400 was also shown to possess considerable activating properties for pyrethrins. The compounds have very low toxicity to mammals, are not irritating and can be made up readily in oil or water.

It is reported in footnotes, that when applied undiluted to the skin of volunteers, B800 repelled Simuliids and *Culicoides* for 2–6 hours and prevented biting for an additional 2–4 hours and B400 prevented *Aëdes sollicitans*, Wlk., from biting for 3–6 hours.

BARBER (G. W.) & SCHMITT (J. B.). **House Flies resistant to DDT residual Sprays.**—*Bull. N. J. agric. Exp. Sta.* no. 742, 8 pp., 1 fig. New Brunswick, N.J., 1948. **Further Studies on Resistance to DDT in the Housefly.**—*J. econ. Ent.* **42** no. 2 pp. 287–292, 1 ref. Menasha, Wis., 1949.

In April 1948, flies were collected from a hotel at Ellenville, New York, where DDT deposits were failing to give adequate control, though they had been used with great success in the two previous years. In the first paper, summarised results are given of numerous experiments made in May and June, in which flies reared from the collected ones and identified by cross breeding with a laboratory strain as *Musca domestica*, L., were tested in the laboratory to determine whether they were resistant to the insecticide [*cf.* *R.A.E.*, B **37** 216]. When first-, second- and third-generation flies of the Ellenville line and flies of a line reared in the laboratory from stock collected in Florida in 1943 were exposed for various periods to identical deposits or series of deposits from acetone solutions, the mortality percentages in the two lines were 27·5 and 99·7, respectively, with technical DDT, 21·3 and 100 with p,p′ DDT, 50·5 and 84·9 with methoxy-DDT and 21·2 and 100 with DDD (TDE), whereas the two lines did not differ in susceptibility to toxaphene, chlordan, γ BHC (benzene hexachloride), parathion or tetraethyl pyrophosphate. It is pointed out that these results show that the only flies that can now be depended on to give reliable results in tests of the powerful new insecticides are members of laboratory strains established before these insecticides were in use.

The studies described in the second paper were made to ascertain whether resistance to DDT and related insecticides persisted in the tenth and eleventh generations of the Ellenville line. The breeding stock had had no contact with insecticides, and no selection had been practised. Mortality percentages among flies of this line and the laboratory line were 50·1 and 100, respectively, with technical DDT, 48·6 and 99·9 with p,p′ DDT and 58·8 and 98·7 with methoxy-DDT. Thus, the Ellenville line still showed considerable resistance to DDT and related insecticides though less than in the first three generations. As before, the lines did not differ appreciably in resistance to toxaphene, chlordan, γ BHC, parathion or tetraethyl pyrophosphate. Flies of the Ellenville line were highly resistant to eight brands of technical DDT, mortalities ranging from 25 to 43 per cent. for six that caused complete mortality of the laboratory strain and being 19·4 and 30·4 per cent. for two that killed 71·6 and 93·1 per cent., respectively, of the laboratory strain. Although deposits of technical DDT, p,p′ DDT and methoxy-DDT were somewhat more effective against Ellenville-line flies at 2 mg. per sq. in. than at 1 mg. per sq. in., concentrations of 3 or 4 mg. were not more effective than 2 mg. Tests using flies of the Ellenville line, the line so far used as control and a line from another laboratory showed that the last two were of comparable susceptibility to deposits of technical and p,p′ DDT. Flies of the Ellenville line survived being repeatedly knocked down by DDT deposits, and those that survived exposure lived for the usual period and deposited the usual number of fertile eggs, from which cultures of vigorous larvae were reared.

Gjullin (C. M.), Sleeper (D. A.) & Husman (C. N.). **Control of Black Fly Larvae in Alaskan Streams by aerial Applications of DDT.**—*J. econ. Ent.* **42** no. 2 p. 392. Menasha, Wis., 1949.

Experiments made in Alaska in 1948, to determine the distance downstream over which a 20 per cent. solution of DDT in Velsicol AR-50 and oil sprayed from aeroplanes could control Simuliid larvae, showed that 0·2 lb. DDT (1 U.S. pint solution) per acre applied to 100 ft. of stream caused all larvae to detach for half a mile and application at the same rate for 400 ft. caused all to detach for two miles. When application was at 0·1 lb. per acre for 800–2,400 ft., all larvae detached for 1–2·5 miles downstream. There appeared to be no correlation between the length of the treated section and the distance over which control was complete. The percentage of partial detachment in one river, however, was somewhat greater where longer sections were treated. Below the 800-ft. treated section, 92 per cent. detached at 3½ miles; below the 1,600-ft. section, 81 per cent. detached at 4 miles, 70 per cent. at 5 miles and 58 per cent. at 7½ miles; and below the 2,400-ft. section, 88 per cent. detached at 6 miles and none at 11. There were no discernible differences in resistance between the various species noted, which comprised *Prosimulium onychodactylum*, D. & S., *Simulium arcticum*, Mall., *S. vittatum*, Zett., *S. corbis*, Twinn, and members of the group of *S. venustum*, Say, and *S. vandalicum*, D. & S.

The population of *S. venustum* and *S. vittatum* was eliminated from a stream inadvertently treated on 13th June in connection with the routine spraying of an Army area, and although eggs and small larvae were observed at intervals after 10th July, the larvae did not develop to pupae until 10th August. It is not known whether enough DDT remained in the water to prevent development or whether it continued to drain into the stream from the head-water bogs in sufficient quantity to kill the newly hatched larvae.

WHITEHEAD (F. E.). **Effect on the Dark Rice Field Mosquito of feeding on Cows treated with DDT.**—*J. econ. Ent.* **42** no. 2 pp. 393–394, 2 refs. Menasha, Wis., 1949.

During the 1948 mosquito season, all livestock and out-buildings within a mile of an isolated rice-field in Arkansas were sprayed with DDT at intervals of about two weeks from the middle of May to late June to observe the effect on mosquito populations. There was some indication of a reduction, but numbers remained large, and the usefulness of livestock spraying for mosquito control appeared questionable. The matter was therefore investigated further in experiments in which individual females of *Psorophora confinnis*, Lynch Arrib., were exposed in wire-screen cages on cows treated with suspensions of 20 or 5 lb. wettable powder containing 50 per cent. DDT per 100 U.S. gals. water or on an untreated cow. Those that fed within 30–45 minutes were removed when feeding was completed and examined about 16 hours later. The stronger spray killed about 84 per cent. during the first three days and about 50 per cent. during the next six days, but very few thereafter. The weaker spray killed about 75 per cent. during the first three days but had little effect after this. In comparison with results obtained against horn flies [*Siphona irritans*, L.] or with deposits on walls, these results were disappointing. The short time spent by the mosquitos on the cows is probably responsible. The DDT had no repellent action.

BALL (H. F.) & ALLEN (T. C.). **Insecticidal Tests of some new organic Phosphates.**—*J. econ. Ent.* **42** no. 2 pp. 394–396, 10 refs. Menasha, Wis., 1949.

An account is given of laboratory tests in Wisconsin in which two newer organic phosphates were compared with parathion and technical tetraethyl pyrophosphate against various species of insects [*cf. R.A.E.*, A **38** 217]. When applied in an oil base, diethyl paranitrophenyl phosphate, parathion (O,O-diethyl O-paranitrophenyl thiophosphate), tetraethyl dithiono pyrophosphate and technical tetraethyl pyrophosphate caused 86, 43, 3·3 and 1·7 per cent. mortality of *Musca domestica*, L., at a concentration of 1 : 8,000 and 65, 10, 3·3 and 0 per cent. at 1 : 16,000. The superiority of diethyl paranitrophenyl phosphate over parathion was further shown in tests with dusts, in which it gave 100 per cent. mortality of *Blattella germanica*, L., at a dilution of 0·00063 (the lowest concentration tested), as compared with 100 and 60 per cent. for parathion at dilutions of 0·005 and 0·0025. Diethyl paranitrophenyl phosphate is a light yellow liquid with practically no odour, has a specific gravity of 1·269 and is soluble in most organic solvents, but fairly insoluble in spray oils unless a mutual solvent is added. At normal temperatures, it is stable to hydrolysis. Its superiority to parathion may be due to the substitution of oxygen for sulphur in the phosphate radical.

HOWELL (D. E.). **Piperonyl Formulations as Horse Fly Repellents.**—*J. econ. Ent.* **42** no. 2 pp. 401–402, 404, 1 fig. Menasha, Wis., 1949.

Of several insecticides tested during recent years in sprays for the protection of cattle from Tabanids in Oklahoma, none gave appreciable mortality of the flies for more than a day or two, and only sprays containing piperonyl butoxide or piperonyl cyclonene were significantly repellent. During August and September 1948, sprays prepared from four emulsion concentrates containing one or other of these ingredients were tested on comparable groups of five cattle. *Tabanus abactor*, Philip, and *T. sulcifrons*, Macq., comprised over 80 per cent. of the flies present. Each animal received 1 litre spray between 7 and 8 a.m. on the first day of each test, and spraying was repeated when the number of flies on the treated animals reached about half that on controls. The amounts of active ingredients per litre in the sprays were 6·67 gm. piperonyl butoxide with 0·67 gm. pyrethrins, 5·33 gm. piperonyl butoxide or piperonyl cyclonene with 0·13 gm. pyrethrins, and 5·33 gm. piperonyl butoxide with 0·13 gm. pyrethrins and 0·67 gm. rotenone. The results obtained are shown in graphs. None satisfied the requirements for use on range cattle (to remain effective for at least a week and be relatively non-toxic and inexpensive), but the first, which gave fair protection for 2–3 days and is relatively non-toxic, was consistently the best [*cf.* also *R.A.E.*, B **37** 155, 161]. Piperonyl cyclonene was less satisfactory than piperonyl butoxide, and the addition of rotenone was without effect.

FRIEND (R. B.). **Connecticut State Entomologist, Forty-sixth Report, 1946.**—*Bull. Conn. agric. Exp. Sta.* no. 512, 114 pp., 12 figs., refs. New Haven, Conn., 1946.

This report contains a section (pp. 36–45) in which R. C. Botsford & J. Elston describe experiments on the use of DDT against salt-marsh mosquitos on the shores of Connecticut in 1946. Additional control was necessary owing to lack of labour to maintain the extensive system of drainage ditches that normally prevents breeding in the marshlands. The principal species involved was *Aëdes sollicitans*, Wlk.; lists of the others observed are given. In the main experiment, eight sections totalling 1,450 acres were sprayed from an aeroplane with 5 per cent. DDT in fuel oil at the rate of 0·3 lb. DDT per acre on 21st–22nd August. Before spraying, larvae were found in all sections, except two that were flooded by every tide and abounded in small fish, and adults were numerous in all except one that had been treated with a DDT fog on 18th July. Highly satisfactory control of larvae was obtained within 24 hours, and larval development was prevented for about 20 days, after which there was a slow increase, though the population after 36 days was still much less than before treatment. Pupae were not appreciably affected. Adults were practically eliminated within four hours of spraying, and only a few newly emerged ones were found after a few days. The only ones present after five days were in the only area in which spray coverage had not been perfect. Adults re-appeared after 19–22 days, but the population had not nearly regained its original level 36 days after treatment. Spraying from the air is therefore considered to be a useful adjunct to the normal method of control by ditching.

In small-scale tests with ground equipment, 5 per cent. DDT in fuel oil was applied to two areas, on 12th July and 9th August, by means of a turbine blower capable of spraying to a depth of 200 ft. from a roadside. Control was excellent in both, and adults are stated to have been kept at a low level for a week in one of them. In the area treated on 18th July, a Todd Insecticide Fog Applicator [*R.A.E.*, B **35** 128] was used to apply 5 per cent. DDT in kerosene and produced a heavy penetrating fog. Control of adults was very satisfactory and remained so for about 12 days, and the biting population was still low after 18 and 27 days. Ground treatment is considered preferable for small areas and aeroplane spraying for large ones.

N. Turner & N. Woodruff describe experiments on factors affecting the toxicity of DDT residues (pp. 93–97). When glass slides were sprayed for various periods with water, kerosene and a solvent (Velsicol AR-50) and weighed immediately after spraying, it was found that the deposit of water was much greater than that of AR-50 and that of kerosene rather less, probably owing to differences in droplet size. Glass and wood plates and wire screens were then sprayed with DDT in water, kerosene or AR-50, dried for 24 hours and exposed to 25–30 house-flies [*Musca domestica*, L.]. The deposit from the water suspension was the most toxic and that from the AR-50 solution usually the least. The addition of a wetting agent (Vatsol) to the water suspension reduced the deposit, but the smaller deposits were about as toxic as the larger deposits without the wetting agent. In a test in which glass slides that had been sprayed with DDT in suspension, solution or emulsified solution were exposed to flies four times at intervals of two days, there was a marked loss of toxicity of the residues with successive exposures. However, similar slides that were not exposed to flies until the last day of the test also showed very low toxicity, and it is concluded that this test did not show that removal of DDT by the test insects [*cf.* **36** 186] was responsible for the losses in toxicity.

An epidemiological Study of Jungle Yellow Fever in an endemic Area in Brazil.—*Amer. J. trop. Med.* **26** no. 6 suppl. 69 pp., 8 figs., 3½ pp. refs. Baltimore, Md., 1946.

This report on an epidemiological survey in progress in 1943, 1944 and 1945 on jungle yellow fever in the neighbourhood of Ilhéus, on the coast of Bahia [*cf. R.A.E.*, B **35** 121 ; **36** 96 ; **37** 214], comprises two parts : **Epidemiology of Human Infections,** by R. M. Taylor & J. Fonseca da Cunha, and **Investigations of Vertebrate Hosts and Arthropod Vectors,** by H. W. Laemmert jr., L. de Castro Ferreira & R. M. Taylor. In the first part, the literature on investigations in Brazil on human cases of jungle yellow fever is briefly reviewed, and an historical account is given of the course of yellow fever around Ilhéus, where reliable information was available from 1930 onwards. The disease had been more or less continually present in Bahia around Salvador, 132 miles north of Ilhéus, for the previous 30 years. In 1930, *Aëdes aegypti*, L., was present in Ilhéus and other towns inland between Ilhéus and Itabuna. It did not penetrate to strictly rural areas or reach villages off the principal lines of communication. It was almost eradicated by 1934, and entirely in 1937, and has not since been found in the region. The last suspected case of yellow fever in the town of Ilhéus occurred in 1933. It was probably of jungle origin. Liver specimens indicating infection with yellow fever were obtained from persons who died between 1934 and 1943 in widely separated rural areas south of Ilhéus and Itabuna. There was a high rate of immunity among members of the victims' families.

The study region and its vegetation, climate and population, and the plan, scope and technique of the work are described. The latter consisted of a search for the virus in mosquitos and ectoparasites by inoculating suspensions of them into susceptible animals, a search for the virus in captured animals by inoculating sera or suspensions of organs into susceptible animals and tests for the presence of specific neutralising antibodies in human sera and sera of forest animals. Efforts were also made to determine the habits and environment that tended to favour human infections and the combination of flora and fauna conducive to the maintenance of the virus in forests. Immune persons were found among rural inhabitants throughout the whole region surveyed except in one area to the north cut off from the rest by a river. The highest percentages of immunity were in districts containing or adjoining extensive forests and among persons who made daily visits to old-type forests (forests more than 75 years old, which had largely reverted to the climax or virgin type). There was some relation between immunity and visits to younger forests, but it was not so marked. The significance of other apparent correlations is discussed. It seemed that observed tendencies for adult males and those who made journeys on foot to have high rates of immunity were really due to the tendency of these groups to visit the old-type forests. The situation of the dwelling in relation to the forest did not in itself appear to be important.

The second part opens with a review of the literature and some unpublished data on vertebrate hosts and Arthropod vectors in South America, followed by descriptions of the four main collecting stations adopted in the present study, accounts of the field and laboratory methods used and details of the results obtained. In all, 5,322 mammals (including 2,300 rodents, 1,851 primates and 1,040 opossums) were collected. Ectoparasites (Pulicids, Ixodids and Laelaptids) were collected from the mammals and were common on the rodents and opossums but rare on the primates. Mosquitos were studied in some detail, and data are given on the relative prevalence of various species in the different kinds of forest, at different levels from the ground and at different times of day. Most attention was paid to *Haemagogus*, examples of which were predominantly, if not entirely, *H. spegazzinii*, Brèth., all males reared from captured females being identified as this species. *Haemagogus* was most frequent in old-type forests and at upper vegetational levels and was most often caught between 9 a.m. and 2 p.m.

A large proportion of sera from certain rodents neutralised yellow-fever virus, but it is believed that this was attributable to some non-specific virucidal substances in the sera rather than to specific immunity. A few opossums gave positive reactions, but although *Metachirus nudicaudatus* and at least one species of *Marmosa* (*M. cinerea*) were found to be susceptible to infection with the strain of yellow fever isolated from marmosets, the neutralisation tests indicated that opossums can seldom be infected in nature. Nearly all the primates tested for neutralising antibodies were marmosets (*Callithrix penicillata*) and 5·8 per cent. of these were positive. One of 11 *Leontocebus chrysomelas* and one of three *Cebus xanthosternus* tested were also immune. The proportion of immune marmosets was highest (23·1 per cent.) in the old-type forests, both the other immune monkeys were from them and *Haemagogus* mosquitos were four times as numerous in these as in other types. Thus, there was an association of immunity both in man and marmosets and of the prevalence of *Haemagogus* with the older climax type of tropical rain-forest.

The virus was isolated from four marmosets and from *Haemagogus* during what appeared to be a transient epizootic among marmosets in the summer of 1944 at Almada, a locality in young-type forest and cacao-growing country. This was the only occasion on which it was isolated from mammals or from mosquitos, of which 12 genera were examined; *Haemagogus* comprised 891 of the 98,432 mosquitos tested from Almada and 8,228 of the 74,441 tested from the other localities. Attempts to isolate the virus from the ectoparasites of the rodents and opossums and from the livers of birds were also unsuccessful.

The evidence suggested that the virus in the region studied is maintained by a primate-*Haemagogus* cycle, and reasons for adopting this view are discussed. Similarities and differences in the presumed epidemiology of jungle yellow fever in Brazil and in Uganda [*cf.* **37** 150, 208, etc.] are briefly reviewed.

Leví Castillo (R.). **Una caja para transportar larvas de mosquito vivas.** [A Box for the Transport of living Mosquito Larvae.]—*Rev. Kuba Med. trop. Parasit.* **3** no. 10 pp. 211–212, 3 figs. Havana, 1947.

In view of the high mortality of mosquito larvae and pupae when they are transported long distances in jars of water, owing to mechanical vibration and shock [*cf. R.A.E.*, B **35** 180], the author, working in Ecuador, designed a small box in which they are carried on damp cotton. The sides are of wood with a metal casing, and the bottom and removable top are of perforated metal. There is a layer of cotton covered by gauze on the bottom. Eggs, larvae and pupae are transferred to the box by means of a dip and, when the water drains away through the bottom, are left with the mud and débris on the gauze. The box can be filled to the top. The lid is then replaced, and water is poured over the box twice a day until the laboratory is reached. Larvae of *Anopheles pseudopunctipennis*, Theo., from Peru survived a three days' journey in the box without loss.

BOHART (R. M.) & INGRAM (R. L.). **Mosquitoes of Okinawa and Islands in the central Pacific.**—*Navmed* no. 1055, ii+110 pp., 71 figs., 2 maps, 3 pp. refs. Washington, D.C., Navy Dep., Bur. Med. Surg., 1946.

Notes are given on the morphology, distribution and bionomics, and usually the taxonomy and the relation to disease if any, of more than 50 species and subspecies of mosquitos from some Pacific Island groups (Hawaii, Samoa, Marshall Islands, Caroline Islands and Mariana Islands) and Okinawa. Brief notes are included on the character of the islands and the most important mosquito-borne diseases on them. The study is based on collections made by the authors and also by other workers, and methods used by the authors for collecting and preserving the material are indicated. Nearly 30 of the species appear to be endemic to some islands or groups. Keys are given to the adults and larvae of the Samoan, Caroline, Mariana and Okinawan species. Three new species of *Aëdes*, one new species and one new subspecies of *Culex* and one new species of *Uranotaenia* are described.

MACCHIAVELLO (A.). **Cutaneous Arachnoidism experimentally produced with the glandular Poison of** *Loxosceles laeta.*—*P. R. J. publ. Hlth* **23** no. 2 pp. 266–279, 3 figs., 4 refs. Brattleboro, Vt., 1947. (Also in Spanish pp. 280–293.)

The results are given of several long series of experiments on the production of cutaneous gangrene in Chile [*cf. R.A.E.*, B **38** 69], in the course of which it was shown that when guineapigs are bitten spontaneously by *Loxosceles laeta*, Nicolet, or when the glandular poison of this spider is injected intradermally into them, the lesions provoked are exactly the same as those produced in man by its bite. Of the 75 individuals of *L. laeta* used in biting experiments, 11 bit spontaneously and 17 more after they had been stimulated to do so. The bites never caused general symptoms and were never fatal. In injection tests with glandular poison, young individuals of *L. laeta* were found to contain a more active poison than adults. Some guineapigs receiving a quantity of poison equal to or exceeding the full contents of both glands died. Injection by various routes showed that the glandular poison acted only on the tissues of the skin. Its potency diminished while the spider was caged. It was coagulant, necrotising and thermolabile but not haemolytic for the red blood cells of the rabbit or the guineapig. It differed from the poison (arachnolysin) from the cephalothorax of the same species, since the latter was not necrotising but intensely haemolytic, especially for the red blood cells of the rabbit.

L. laeta was frequently found by the author in homes in Guayaquil, Ecuador, in 1942 and later in Lima, Peru.

A list is given of 17 other spiders taken in northern Chile, which with *L. laeta* represent about 95 per cent. of the arachnids found there, with notes on the effect of the bites of most of them on guineapigs. The only ones that killed guineapigs were *Latrodectus mactans*, F., which caused their death after 4–18 hours, unidentified species referred to as a Theraphosid and " migalas ", which killed them in a few minutes, and *Dysdera maxima*, Nicolet.

KING (W. V.) & GAHAN (J. B.). **Failure of DDT to control House Flies.**—*J. econ. Ent.* **42** no. 3 pp. 405–409, 8 refs. Menasha, Wis., 1949.

A few reports were received in 1947 and many in 1948 of the failure of DDT deposits to control *Musca domestica*, L., in the United States under conditions in which similar deposits had formerly proved highly successful. Preliminary tests with flies from various localities near Orlando, Florida, indicated that the chief cause was an increased resistance of the flies to the insecticide, probably as a result of exposure of the strain in treated buildings for 1–4 years.

The literature on resistant strains of *M. domestica*, some of which has already been noticed [*R.A.E.*, B **37** 216 ; **38** 87], is reviewed. Flies belonging to strains obtained from seven localities in five States all showed a greater resistance to DDT deposits (25 mg. per sq. ft.) than flies from two laboratory colonies that had never been exposed to the compound but much greater susceptibility than a special resistant colony that had been developed experimentally at Orlando by subjecting members of every generation to a sub-lethal dosage of DDT spray and breeding from the survivors. The exposure time required for 70 per cent. mortality ranged from 8 to 67 minutes for flies from natural sources, as compared with averages of 1·8 and 1·5 for the two susceptible laboratory strains and 222 for the resistant colony. In the 15th, 16th and 17th generations, flies of this colony had tolerated about twice as much spray, or exposure to deposits for about twice as long, as the stock from which they had been taken, and they had also shown increased resistance in about the same degree to chlordan, toxaphene, pyrethrum, rotenone and Thanite (isobornyl-thiocyanoacetate). The increased resistance to DDT appeared to be lost in about the same number of generations in a section of the colony that was reared without further exposure to it.

Chemical analysis of various samples indicated that the DDT used in 1948 was of as good quality as that used in previous years, and tests with caged flies failed to yield evidence that freshly applied deposits on the walls of buildings were less toxic than formerly. In many buildings, more flies were found resting on untreated surfaces than on treated walls and ceilings. However, although heavy deposits of DDT (0·8 and 3 gm. per sq. ft.) showed some repellency, the more usual dosage of 0·2 gm. was practically non-repellent. Heavy deposits of wettable chlordan and methoxy-DDT (methoxychlor) were non-repellent or even slightly attractive. Technical benzene hexachloride (12 per cent. γ isomer) was somewhat more repellent and a partly refined product (25 per cent. γ) somewhat less repellent than DDT. Preliminary tests indicated that the increased resistance to DDT was much greater than it was to methoxy-DDT, chlordan or benzene hexachloride. Two of the barns in which DDT had proved unsatisfactory were sprayed with chlordan emulsions at 200 mg. insecticide per sq. ft. and two others with suspensions of methoxy-DDT at the same rate. Both treatments were providing a high degree of control after 7–11 weeks.

FAIRCHILD (H. E.), HOFFMAN (R. A.), LINDQUIST (A. W.) & MOTE (D. C.). **A Comparison of the chlorinated Hydrocarbon Insecticides for Control of the Sheep Tick.**—*J. econ. Ent.* **42** no. 3 pp. 410–414, 5 refs. Menasha, Wis., 1949.

Wettable powders containing 50 per cent. DDT, methoxy-DDT (methoxychlor), BHC (benzene hexachloride), DDD (dichlordiphenyldichlor-ethane) or chlordan or 25 per cent. toxaphene were compared with a rotenone powder (5 per cent. rotenone) in dips and sprays for the control of keds (*Melophagus ovinus*, L.) on farm flocks of sheep near Corvallis, Oregon, in 1947–48. In dipping tests, all the synthetic insecticides at concentrations of 0·2 and 0·5 per cent. caused complete control for the whole period of the test (110 days). At 0·05 per cent., DDT, methoxy-DDT and DDD gave 97, 96 and 91 per cent. reduction 42 days after dipping, while the other synthetic insecticides at the same concentration and the rotenone powder at 16 oz. per 100 U.S. gals. gave complete control. After this, 10–20 keds per animal were placed on these sheep at intervals of about three weeks, up to a total of 70. Some survived on each animal, but no thriving colony was established. After 110 days, the percentage reductions effected as compared with the original infestations were 97 for methoxy-DDT, 94 for toxaphene, 98 for BHC, 70 for DDT, 89 for DDD, 84 for chlordan, and 91 for rotenone powder (4 oz. per 100 U.S. gals.). The rotenone powder at 8 and 16 oz. to 100 U.S. gals. water gave excellent results. When house-flies (*Musca domestica*, L.) were exposed to samples of wool collected from the treated sheep within two months of dipping, all wool from sheep dipped in the synthetic insecticides at 0·05 per cent. killed all flies in 24 hours. Wool from animals dipped in rotenone gave 90–100 per cent. kill. BHC and chlordan had the most rapid action. In samples taken after 84 and 110 days, BHC, chlordan and DDD gave complete kill in 24 hours' exposure, methoxy-DDT, toxaphene and DDT gave about 80 per cent., and rotenone 60 per cent.

Experiments with sprays applied at a pressure of 300–350 lb. per square inch showed that this method of application is not completely satisfactory for sheep in heavy fleece. When about 6·7 U.S. quarts of 0·05, 0·2 and 0·5 per cent. spray were used per animal, BHC and chlordan at all concentrations and toxaphene at all but the lowest gave complete control six weeks after treatment and maintained it for the remainder of the 110 days of the test, in spite of re-infestation of the animals treated with the lowest concentration as in the dipping tests. Methoxy-DDT was not quite so effective and DDT and DDD were much inferior. Rotenone gave complete control throughout the test at 16 oz. powder per 100 U.S. gals. but not at 4 or 8 oz. Wool samples from sheep sprayed with the weakest concentration killed all house-flies exposed to them in the first two months. After 110 days, BHC still gave complete kill and toxaphene, DDD, DDT and rotenone 87, 89, 84 and 70 per cent., respectively. In a spray test on ewes with long dense fleece in which about 4 U.S. quarts per animal were used and the nozzle was held 6–10 ins. from the wool, poor results were obtained with nearly all the insecticides. Exposure of wool to *M. domestica* gave erratic results, though most of the chemicals caused 95–100 per cent. mortality during the first two months. When similar ewes were sprayed with 2·7 U.S. quarts of the synthetic insecticides at 0·2 per cent. strength and the nozzle touched the wool, none of the treatments consistently killed all the keds during the test period. Chlordan, BHC, toxaphene and methoxy-DDT gave better results than DDT and DDD. Wool samples treated with BHC, chlordan, methoxy-DDT and DDT gave complete kill of *M. domestica* at each of seven collection periods, up to and including the 84th day after treatment. DDD and toxaphene were slightly less effective, and rotenone gave poor results.

Keds were observed to migrate over the surface of the wool on days when the air temperature reached about 70°F. It is suggested that where the spray does not penetrate to the skin, the keds may survive until the weather stimulates migration to the surface.

It is concluded that BHC, chlordan and toxaphene appeared to be the most effective insecticides, but that rotenone also gave good results and because of the small amount needed is by far the least expensive treatment. At 8 oz., cubé or derris powder containing 5 per cent. rotenone is from one-fifth to one-tenth as expensive as some of the chlorinated hydrocarbons.

Pratt (H. D.), Lane (J. E.) & Harmston (F. C.). **New Locality Records for *Allodermanyssus sanguineus* Vector of Rickettsialpox.**—*J. econ. Ent.* **42** no. 3 pp. 414–415, 1 fig., 4 refs. Menasha, Wis., 1949.

Records are reviewed of the occurrence in the United States up to 1946 of *Allodermanyssus sanguineus*, Hirst, which has been shown to be a vector of rickettsialpox in New York City [*R.A.E.*, B **37** 165]. They include, in addition to those mentioned by Ewing [**32** 22], one from Indiana and one from Massachusetts. In a survey of the ectoparasites on domestic rodents in the New York City area, 92 out of 963 house mice (*Mus musculus*) examined bore *A. sanguineus*, the number varying from one to 20 per mouse, but no mites of this species were found on 121 domestic rats, and none has been recognised in collections of ectoparasites from 4,070 examples of *Mus* (*Rattus*) *rattus* and *M.* (*R.*) *norvegicus* trapped from September 1945 to June 1948 in nine south-eastern States from Texas to North Carolina. However, a recent study of two collections of rodent ectoparasites showed that *A. sanguineus* was taken in September and November 1948 on *M. norvegicus* in a building in Salt Lake City, Utah, as well as on *M. musculus* in Illinois in 1934. Characters are given for distinguishing females of *A. sanguineus* from those of *Dermanyssus* and females of these two genera from those of other parasitic Dermanyssids and Laelaptids.

PARISH (H. E.). **Recent Studies on Life History and Habits of the Ear Tick.**—*J. econ. Ent.* **42** no. 3 pp. 416–419, 1 ref. Menasha, Wis., 1949.

Otobius megnini, Dugès, is a serious pest of cattle, sheep and other domestic animals in the semi-arid part of the south-western United States, and was found to be responsible for 4 per cent. of 5,812 cases of infestation by screw-worm [*Callitroga* (*Cochliomyia*) *hominivorax*, Coq.] reported during investigations in two Texas counties in 1936–40 [*cf. R.A.E.*, B **31** 152]. It is also sometimes responsible for fatal screw-worm infestation of farm dogs. As many as 100 individuals have been removed from the ear of one cow. Serious consequences of infestation include loss of weight, wool, mohair and milk, and in the case of working animals, efficiency. Nymphs have been collected from cattle, sheep, goats, dogs, deer and man, near Menard, Texas. Some individual sheep and cattle appeared to be resistant to infestation.

The life-history of *O. megnini* was investigated in Texas in 1942–43. The eggs were laid in masses and the incubation period varied from 50 days for those laid in February to seven days for some laid in the height of summer. Soon after hatching, the larvae crawl up any available object to await hosts. They became engorged in about 5–10 days after reaching the external ear of the host and moulted in it 1–5 weeks later. The nymphs began to engorge very soon and continued to do so for two months or more. When fully engorged, they detach, fall to the ground and seek cover for the final moult. Mortality was high during this moult and shortly after adult emergence. The adults do not feed. Mating was shown to be necessary for oviposition, but females fertilised once laid viable eggs throughout life. The pre-oviposition period of 64 females averaged 12·5 days in the laboratory in April and May. From June to the end of September, the average number of eggs per female deposited by 20 females was 1,444 in 5·8 masses. When 375 adult ticks were kept under observation in simulated natural conditions throughout the winter, only two small egg batches, from each of which one larva hatched, were laid during November and December, and only four small masses during February, which did not hatch until 10th April. No eggs were laid in January. Of larvae kept without food, most died in 30–40 days and all in 66 days. One adult lived for 472 days.

All mobile stages were remarkably resistant to submergence, and it is suggested that the species may be disseminated by water. Adults, engorged nymphs and newly hatched larvae showed some mortality after submergence for 4, 16 and 53 hours, respectively, and complete mortality in 49, 97 and 163 hours. Engorged nymphs and adults crawled only a few inches if cover was available, and mortality of the former was high after exposure for a few minutes on soil at temperatures of 120–128°F. These soil temperatures are not uncommon in many parts of the south-western States. Small black ants (*Monomorium minimum*, Buckley) fed on newly emerged adults in the laboratory, and large red ants (*Pogonomyrmex barbatus* var. *molefaciens*, Buckley) attacked adults and fully engorged nymphs in the field, but no parasites of the ticks were found.

Collection of non-parasitic stages from various situations showed that large numbers congregate in the débris under salt troughs in pastures. Few were found elsewhere. The numbers under the troughs varied in proportion to the number of animals kept in the pastures and according to the kind of animal. Fewer ticks were found under troughs that stood in water during rainy spells than under those on rocky slopes. The largest number found under any one trough was 2,095. Ticks were found under salt troughs in each month of the year, but were most numerous between April and July and least so from December to March. This congregation under salt troughs suggests a new possibility of control.

Burgess (A. F.) & Sweetman (H. L.). **The residual Property of DDT as influenced by Temperature and Moisture.**—*J. econ. Ent.* **42** no. 3 pp. 420–423, 1 fig., 9 refs. Menasha, Wis., 1949.

The literature on the factors affecting the loss of toxicity of DDT deposits is briefly reviewed, and the results are given of further investigations in a basement laboratory on the influence of temperature and moisture on the toxicity of such deposits [*cf. R.A.E.*, B **36** 186], the test insect being *Musca domestica*, L. Pieces of galvanised and black enamelled wire gauze were dipped in a solution of 5 per cent. DDT in kerosene, dried and kept in the laboratory and in special chambers maintained at 23, 27, 32, 34 and 37°C. [73·4, 80·6, 89·6, 93·2 and 98·6°F.] with moist conditions (60–75 per cent. relative humidity) and dry ones (25–40 per cent.) at each temperature, except 34 and 37°C., which had moist conditions only. The toxicity was tested periodically for three years. In the first tests, made 1–5 months after treatment, mortality was complete in all cages, usually in less than 48 hours, but one test required 67 hours. In the second tests, made 17–18 months after treatment, the average percentages of flies killed in 72 hours and (in brackets) the conditions under which the screens had been stored were 52·6 (37°C.), 100 (32°, moist or dry), 94 (27°, moist), 91·2 (27°, dry), 87·2 (23°, moist) and 89 (23°, dry). No test was made of screens kept at 34°. After storage for 34–39 months, the corresponding figures were 9·4 (37°C.), 53·4 (34°), 13·8 (32°, moist), 91·4 (32°, dry), 96·2 (27°, moist), 77·6 (27°, dry) and 100 (23°) ; the screens kept at 23° had been kept under moist or dry conditions for the first 18 months and under normal laboratory conditions for the rest of the period. The screens increased in weight after treatment for two weeks or more, probably partly as a result of the accumulation of dust, and afterwards decreased slightly. There was some correlation between the initial gain in weight and the effectiveness of the screens 34–39 months later.

Wilson (C. S.). **Piperonyl Butoxide, Piperonyl Cyclonene, and Pyrethrum applied to selected Parts of individual Flies.**—*J. econ. Ent.* **42** no. 3 pp. 423–428, 5 refs. Menasha, Wis., 1949.

Synergists are difficult to study because separation of the factors involved is likely to destroy synergistic action. Lindquist and his associates [*R.A.E.*, B **37** 81] showed that doses of some synergists could be separated in time from accompanying doses of pyrethrum and still be effective. However, with the technique they used, it was not possible to tell whether the surface at the place of entry of the pyrethrum was conditioned by the synergist or whether some internal structure or system was conditioned by synergistic material that might have been absorbed from a different part of the insect. A simple and fairly rapid technique is described for administering predetermined doses of insecticides or synergists to chosen areas on adult flies. The fly is immobilised in a tube by gently pressing it with a pad against a cupped wire screen. A droplet of solution is picked up on a fine wire loop of suitable size, which is thrust through one of the openings of the screen to enable the droplet to be deposited on the desired part of the fly.

Preliminary tests using this technique were made at Corvallis, Oregon. The effect of a given dose of pyrethrum in refined deodorised kerosene (in this case a 0·4 per cent. solution of pyrethrins made by diluting a commercial concentrate containing 20 per cent.) was shown to depend largely on the site to which it is applied. When placed on the top of the thorax, 0·1 mmg. pyrethrins knocked down only 40 per cent. of *Musca domestica*, L., and 85 per cent. of *Calliphora vomitoria*, L., the average times required being 13 and 14 minutes, respectively. The same dose applied to the mouth-parts required an average of only one minute to give complete knockdown of both species. Knockdown was also complete when application was made to the thoracic spiracle, but with *M. domestica*, the time needed was slightly longer. As little as 0·01 mmg. pyrethrins caused immediate knockdown of *M. domestica* when applied to the thin membranes of the neck and between the cocci, but 0·1 mmg. had no more effect when applied to the membranous bottom of the abdomen than when applied to the top of the thorax. Distance from large masses of nerve tissue may be responsible.

Piperonyl butoxide, piperonyl cyclonene and the diallyl ester of succinic acid were applied as 4 per cent. solutions in a mixture of deodorised kerosene and cyclohexanone (3 : 1), sometimes alone and sometimes with 0·4 per cent. pyrethrins. The diallyl succinate was tested with pyrethrum on *M. domestica* but had no visible effect. The most conspicuous effects of the piperonyl compounds were to inhibit recovery from knockdown by pyrethrum. When either was applied to a part different from that on which pyrethrum was applied, the effect was nearly as great as that produced by the same compound applied with the pyrethrum in the same solution. Without pyrethrum, neither compound had any visible effect. When the pyrethrum was applied to the top of the thorax, the addition of either synergist to it or application of the synergist to the abdomen increased the time needed for knockdown as well as the percentage knockdown.

The mechanism of synergism is discussed in the light of these results. Inhibition of recovery suggests damage to the detoxifying mechanism. A brief account is given of incidental tests that suggested strongly that the effect is achieved by the action of the synergist on tissues situated near those affected by the pyrethrum. The hypothesis put forward is that the site of critical action of the pyrethrum and the synergist is the nerves, but the two types of material affect different parts of the cells ; piperonyl butoxide, piperonyl cyclonene, and perhaps other piperonyl compounds that inhibit recovery from knockdown, cause long-lasting damage to the nerve cell bodies, whereas pyrethrum affects the fibres. The damage to the cell bodies may not noticeably impair the functioning of the nerve fibres, but seriously interferes with repair of damage done to them by pyrethrum, and to obtain supplementary action it is necessary for both types of chemicals to act on the same cells.

HOFFMAN (R. A.) & LINDQUIST (A. W.). **Fumigating Properties of several new Insecticides.**—*J. econ. Ent.* **42** no. 3 pp. 436–438, 1 ref. Menasha, Wis., 1949.

A fumigating action resulting from space sprays or deposits greatly enhances the value of a contact insecticide for the control of certain insects, particularly those inhabiting enclosed spaces such as houses and warehouses, and contact insecticides having a fumigant action may also be more effective than others in controlling external parasites on animals with long hair or wool. Laboratory tests were therefore made to determine the fumigating effect of DDT, BHC (benzene hexachloride) as the technical product (12·8 per cent. γ isomer) and as 95 per cent. γ isomer, chlordan, toxaphene, DDD (dichlordiphenyldichlorethane), fluoro-DDT (the fluorine analogue of DDT) and parathion on *Musca domestica*, L. Wide-mouthed U.S. quart jars were coated on the inside with acetone solutions of the various chemicals at rates of 10 and 100 mg. per sq. ft. and placed mouth to mouth over or beneath untreated jars containing 50–75 reared house-flies 3–5 days old, with a clean 16-mesh wire screen between to prevent the flies from coming in contact with the treated surface. With this arrangement, it might be possible to determine whether the vapours were heavier or lighter than air by noting differences in knockdown or mortality. Flies were exposed at room temperatures (75–80°F.) for six hours at irregular intervals over periods of several months and then transferred to clean containers for 24 hours. The treated jars were stored upright and left uncovered at room temperature between tests.

In general, the results obtained with the flies in the two positions were similar, indicating that the fumes from the chemicals could fill an enclosure whether it was above or below their point of liberation. DDT, which was tested at the higher rate only, killed no flies and caused no knockdown. At the higher rate, DDD and toxaphene caused 78 and 97 per cent. mortality and the other insecticides complete mortality in 24 hours half a day after the jars were treated. BHC (95 per cent. γ isomer) and parathion gave complete kill of flies exposed after 307 days and 15 and 95 per cent. after 339 days, and chlordan and fluoro-DDT gave complete mortality for 84 and 145 days, respectively, and high kills for up to 211 days. Technical BHC gave 100 per cent. mortality after 84 days but only 16 after 211. At the lower dosage, the duration of effectiveness of the various deposits was markedly less, but technical BHC, 95 per cent. γ BHC and parathion caused 100 per cent. mortality after 43 days ; none of the compounds caused high mortality after 82 days. Fluoro-DDT was not tested at this dosage. The knockdown was usually more rapid at the higher than at the lower rate, BHC giving the most rapid knockdown of all the materials and parathion giving an erratic knockdown in six hours. Toxaphene and DDD gave the slowest knockdowns. Similar tests with the α, β and δ isomers of BHC revealed no marked fumigating action. After 90 days, flies were exposed in the jars treated at 10 mg. to test the effectiveness of contact with the residues. Both technical BHC and 95 per cent. γ isomer gave only partial kill in 24 hours, but parathion, DDD and toxaphene gave complete knockdown in 30, 43 and 125 minutes, respectively.

It is concluded that most of the new insecticides act by fumigation as well as by contact, and that when chemical residues are being tested for their contact effect on insects, consideration should be given to the part that the fumes may play.

Smith (C. N.) & Burnett jr. (D.). **Effectiveness of Repellents applied to Clothing for Protection against Salt-marsh Mosquitoes.**—*J. econ. Ent.* **42** no. 3 pp. 439–444, 3 refs. Menasha, Wis., 1949.

The following is based partly on the authors' summary. In the course of a study of mosquito repellents in Florida, 375 compounds that had shown promise in the laboratory for use to impregnate clothing and were available in sufficient quantity were tested in the field against salt-marsh mosquitos (*Aëdes taeniorhynchus*, Wied., and *A. sollicitans*, Wlk.) by impregnating stockings with acetone solutions at 3 gm. repellent per sq. ft. Of these compounds, 92 were effective for more than 21 days of ageing, and the 79 of these that were available were retested at 0·75 gm. per sq. ft. The 43 that were effective for 14 days at the reduced dosage and had not shown undue irritant properties, odour or probable toxicity, and 14 that had given complete protection for 40 days at the higher dosage were subjected to extended wearing tests, and 31 were effective after at least 36 hours of wear. The results obtained with the 92 compounds and lists of the less effective ones are given.

The outstanding repellents included : N-cyclohexyl-β-butoxyethoxyacetamide (effective after 451 days of ageing in the laboratory and more than 123 days of ageing (3 gm. per sq. ft.) and 72 hours of wear (0·75 gm. per sq. ft.) in the field), which was the best ; 2-ethyl-2-butyl-1,3-propanediol ; 2-ethylhexy diethylene glycol monoether ; N-(mixed monoamyl)imide of 3,6-endomethylene-4-cyclohexene-1,2-dicarboxylic acid ; isobornyl ester of 4-morpholineacetic acid ; and undecylenic acid. The n-propyl ester of N,N-diethylsuccinamic acid, the n-butyl ester of mesityl oxide oxalic acid (Indalone), and the ethyl ester of β-phenyl-β-hydroxypropionic acid were among the more effective repellents, and are of special interest because they are also effective when applied to the skin. Additional toxicological studies will be necessary before unrestricted use of most of the compounds can be recommended.

SCHWARDT (H. H.). **Diagnosis and Control of Mange in Dairy Cattle.**—*J. econ. Ent.* **42** no. 3 pp. 444–446. Menasha, Wis., 1949.

Cattle mange caused by *Sarcoptes caprae*, Fürst., and *Chorioptes bovis*, Gerl., is apparently increasing in the north-eastern United States. It was still uncommon in New York in 1943, but the number of cases reported has increased steadily since. In a survey made in that State during the winter of 1947–48, mange was diagnosed in 720 herds comprising 21,000 dairy cattle. With one known exception, beef cattle were not infested. Cattle died in several herds when the condition was not recognised early, and in many others there was loss of condition and of milk production.

Mange is diagnosed by microscopic examination of deep skin scrapings, and in some cases special preparation of the material is advisable. A method of examination devised by D. W. Baker that has often enabled a positive diagnosis to be made when microscopic examination alone has failed is described. Scrapings deep enough to draw blood are made from the edges of apparently active lesions and examined under the microscope. If no mites are seen, material from the scraping is placed in 30–50 cc. 10 per cent. potassium hydroxide or sodium hydroxide, heated nearly to boiling point and allowed to simmer for several minutes to destroy hair and other detritus. The liquid with any mites it may contain is then centrifuged and most of the liquid poured off. The sediment is washed several times and brought down by centrifuging after each addition of water. After the final washing, the water is poured off and the tube half filled with a solution of 1 lb. sugar in 1 U.S. pint water. The sediment is then stirred up and the tube filled with solution so that a cover slip placed over the opening makes complete contact with the liquid. The solution is centrifuged, and any mites present then adhere to the cover slip, which is removed and placed on a slide for examination. This procedure is particularly useful for *Sarcoptes* mites, which are the most difficult to find in untreated scrapings.

In the northern United States, nearly all serious cases of mange occur during winter. The mange is often most apparent soon after the herds are turned out in the spring, and disappears during the summer, but usually recurs after the herd is stabled for the winter. Dipping is impracticable as a means of control in New York because the herds are too small to make it economic, the rough handling would probably be more harmful than the mange, and dipping during the cold weather prevailing at the appropriate time would be dangerous. Spraying with high pressure equipment has given excellent control for three seasons. A sprayer having a tank capacity of 150 U.S. gals. and a pump capacity of 7–10 U.S. gals. per minute and developing about 400 lb. pressure was the most suitable, and at least 2 U.S. gals. was used per animal. Herds receiving four weekly applications of lime-sulphur solution (1 : 15) or wettable sulphur (20 or 30 lb. per 100 U.S. gals.) were free of mange mites eight months after spraying. Herds sprayed four times with a mixture of 20 lb. wettable sulphur and 1 lb. 5 per cent. rotenone in 100 U.S. gals. were freed of mange and remained free for several months, but two applications were less satisfactory. The rotenone was added to control lice. In tests with BHC (benzene hexachloride) during the late winter and early spring of 1948, a single application of 4 lb. powder containing 6 per cent. γ BHC per 100 U.S. gals. caused an immediate and considerable improvement, but three of the five herds treated suffered a recurrence of mange within six weeks. Two of them were resprayed a month after the first application with 6 lb. powder per 100 U.S. gals. but had mange again within a year. Of eight herds treated with the stronger spray, mange recurred in three. However, several appeared to be cured, and milk production was much improved. It is concluded that at least two applications of a spray containing 6 lb. 6 per cent. γ BHC are necessary. This is the strongest dosage considered safe. No complaints of the tainting of the milk were received, and chemical analysis indicated that the milk of cows sprayed with the stronger concentration contained less than 4 parts BHC per million within a few hours of treatment and none after a week.

DEONIER (C. C.), SULLIVAN (W. N.), NOTTINGHAM (E.) & LINDQUIST (A. W.). **Control of *Anopheles* Mosquitoes with coarse and fine DDT Sprays applied by Airplane.**—*J. econ. Ent.* **42** no. 3 pp. 447–450. Menasha, Wis., 1949.

Experiments were carried out in Florida in 1945 to compare the efficiency of coarse and fine sprays of a solution of DDT in oil applied by aeroplane for the control of *Anopheles quadrimaculatus*, Say. The fine spray (50–65 microns) was applied from an exhaust venturi and the coarse spray (150 microns) from a gravity-fed straight-discharge pipe. The test areas are described. Three applications were made, on 7th August, 1st September and 18th October, respectively, the two types of sprays being applied simultaneously in the early morning, when conditions are best for the settling of fine particles. The first and third applications were at the rate of 0·3 lb. DDT (1·5 U.S. pints spray) and the second at 0·6 lb. DDT (3 U.S. pints spray) per acre. The two types of spray were equally effective against adult Anophelines, reducing populations by 98 per cent. or more in 24 hours at the second and third applications. Results of the first application were confused by infiltration and rain. The fine sprays killed adults more quickly than the coarse sprays but did not give so heavy a deposit. Rains apparently reduced the duration of effectiveness of the treatments. Excellent control of larvae was obtained ; 24 hours after the first application, it was 99·7 per cent. in each area. The period of control was longer in the area receiving the coarse spray. Mosquito populations were kept low by the sprays for about 10–14 days during the active breeding season. It is concluded from these results that the coarse sprays obtained from a straight-discharge pipe give just as good control as the fine sprays produced by the more complex exhaust equipment, that allowing for the developmental period of the parasite, monthly spraying should be an effective malaria control measure, and that experiments should be made with dosages lower than 0·3 lb. per acre.

TRAVIS (B. V.). **Studies of Mosquito and other biting-insect Problems in Alaska.**—*J. econ. Ent.* **42** no. 3 pp. 451–457. Menasha, Wis., 1949.

The control of mosquitos, Simuliids and *Culicoides* was studied in several parts of Alaska in 1947 and 1948, and a summary of the results is given. Pre-hatching treatments for the control of *Aëdes* larvae made in August before freezing or in spring while the breeding areas were still covered with snow and ice were effective only on some marshes. As little as 0·1 lb. per acre of DDT, the most promising material tested, was effective in some types of breeding areas, whereas 2 lb. per acre failed to give satisfactory control in others. Fuel-oil solutions and emulsified solutions were more effective than wettable-powder sprays or dusts. No difference was noted between the autumn and spring treatments. In conventional larvicidal applications, DDD (dichlordiphenyldichlorethane) and methoxy-DDT (methoxychlor) at 0·1 lb. per acre in 2 U.S. quarts fuel oil were about as effective as DDT. Treatment of a plot 30 square miles in area did not prevent infiltration of adults from surrounding areas.

The use of heat-generated aerosols for the control of adult mosquitos, *Culicoides* and Simuliids was practicable only in the few areas where adequate cross-roads were present. Treatment of an area of about a square mile with DDT aerosol against *Culicoides* adults gave more than 90 per cent. control and provided temporary relief, but infiltration began almost at once. Infiltration completely masked the effect of treatment against Simuliid adults. Plots with an area of 24–30 square miles sprayed with DDT from the air for the control of adult mosquitos required re-treatment every 7–10 days [*R.A.E.*, B **38** 52]. A dosage of 0·1 lb. DDT per acre appeared to be adequate. DDT, DDD and methoxy-DDT were about equally effective against Simuliid larvae and were better than BHC (benzene hexachloride), chlordan or chlorinated camphene [toxaphene]. Parathion was more effective than other materials, but was not sufficiently superior to warrant its use in streams where fish are present. DDT at 0·4 parts per million applied in fuel-oil solution to the surface of streams was the most practicable treatment. Aerial applications of DDT at 0·1 lb. per acre to swathes 400–2,400 ft. wide across streams caused larvae to detach for 1–2·5 miles downstream [**38** 88]. Comparative field tests with promising repellents against mosquitos (*Aëdes* spp.) showed the four standard repellents (dimethyl phthalate, Indalone, 2-ethyl-1,3-hexanediol, and the mixture of these in the proportion 6–2–2) and n-propyl N,N-diethyl succinamate to be the best for application to the skin. None was effective against *Culicoides*. For impregnation of clothing, n-hexyl mandelate was best. It remained effective after 13 rinsings and 40 hours' wear.

Surveys were made over the whole road system of Alaska to determine the species of blood-sucking Diptera present and their distribution and abundance. Large numbers were reared individually to allow of identification and association of mature and immature stages. Mosquitos, *Culicoides*, Simuliids, *Symphoromyia* or mixed populations of these occurred in every community in sufficient numbers to cause annoyance. Notes are given on relative abundance and aggressiveness. Studies on the effect of several insecticides on fish and fish food (caddis larvae) showed that DDT caused no damage to either at 60 and 30 p.p.m., respectively [*cf.* **38** 51]. Good correlations were shown between plant associations and mosquito-breeding habitats and between the various microclimatic factors and the flight habits of mosquitos and *Culicoides*. Improved spray-boom equipment, which delivered droplets with a mass median diameter of 136 microns over a swathe 800 ft. wide was developed for use on a testing aeroplane.

EDDY (G. W.) & McGREGOR (W. S.). **Use of White Mice for testing Materials used as Repellents and Toxicants for Stable Flies.**—*J. econ. Ent.* **42** no. 3 pp. 461–463, 1 fig., 1 ref. Menasha, Wis., 1949.

The following is taken from the authors' summary. A method is described whereby white mice are used as test animals for the preliminary evaluations of materials as repellents and toxicants for *Stomoxys calcitrans*, L. The materials are applied to the mice as acetone solutions with an electric air-blowing paint sprayer. The mice are exposed to hungry flies 24 hours after treatment, to determine the degree of repellency and the toxicity of the materials to the feeding flies. The results obtained with several materials are shown. Those obtained on mice appeared sufficiently comparable with those obtained on cattle to warrant the use of mice as test animals.

GERSDORFF (W. A.). **Toxicity to House Flies of synthetic Compounds of the Pyrethrin Type in Relation to chemical Structure.**—*J. econ. Ent.* **42** no. 3 pp. 532–536, 3 graphs, 6 refs. Menasha, Wis., 1949.

Investigations on the constituents of pyrethrum flowers have shown the existence of two closely related compounds termed cinerin I and cinerin II, in addition to pyrethrins I and II. The cinerins have a somewhat simpler structure than the pyrethrins and would be less difficult to prepare synthetically. They have been shown to be more stable than the pyrethrins, and since the corresponding esters possess about the same order of toxicity to *Musca domestica*, L. [*cf. R.A.E.*, B **37** 67], efforts were directed to the synthesis of cinerin I, the chrysanthemum monocarboxylic acid ester of 2-(2-butenyl)-4-hydroxy-3-methyl-2-cyclopenten-1-one. An isomer differing chemically from cinerin I was subsequently synthesised, but was considerably less toxic. A method has now been devised for the synthesis of cyclopentenolones analogous to cinerolone, but differing from it in the nature of the substituent groups in the nuclear 2 and 3 positions. These compounds, when esterified with chrysanthemum monocarboxylic acid furnish esters analogous to cinerin I. Toxicity had been shown to be independent of the presence of optical activity in the keto-alcoholic component of both types of pyrethrins and cinerins [*cf.* **37** 155], but the effect on toxicity of changes in the substituent groups remained to be investigated.

Seven substituted cyclopentenolones were prepared, and these and a similar uncyclised compound were esterified with natural *d-trans*-chrysanthemum monocarboxylic acid; two of them were also esterified with the synthetic racemic (*dl*) *cis* and *trans* forms of this acid. These twelve chemically pure compounds, closely related to cinerin I, were dissolved in refined kerosene at selected concentrations and compared with a kerosene extract of pyrethrum flowers, in which 56 per cent. of the " total pyrethrins " consisted of pyrethrin I and cinerin I, against *M. domestica* by the turntable method [**26** 246]. Knock-down and mortality percentages were determined in as many replicated tests as possible at concentrations selected according to preliminary tests, and about 100 flies, 2–4 days old, were used in each test. The tests were begun immediately after the preparation of the materials, and these were stored at 2°C. [35·6°F.] when not in use.

The following is based on the author's summary of the results obtained. The *d*-chrysanthemum monocarboxylic acid ester of synthetic 2-(2-butenyl)-4-hydroxy-3-methyl-2-cyclopenten-1-one (probably a geometric isomer of cinerolone) was as toxic as natural cinerin I and about 1·5 times as toxic as the mixture of " pyrethrins " contained in the ordinary pyrethrum-kerosene extract. The replacement of the 2-butenyl side chain of these compounds with the allyl group was accompanied by a nearly five-fold increase in toxicity, whether the acid component was the dextro natural one or a racemic *cis* or *trans* synthetic one. The allyl compound with the natural acid component was the most toxic of any of the known pyrethroids, 6–7 times as toxic as the mixture of " pyrethrins ". No difference in toxicity was found between the compounds with the *cis* and *trans* forms of the acid component in either the 2-butenyl or the allyl compounds. For both classes, the ester with the natural dextro acid component was about 3·8 times as toxic as an ester with a synthetic racemic acid component. The completely synthetic isomers of cinerin I were about 0·39 times as toxic and the completely synthetic allyl compounds about 1·8 times as toxic as the mixture of "pyrethrins". Other changes in chemical structure were shown to reduce toxicity. Knockdown effect was of a high order for all the compounds.

EDDY (G. W.) & McGREGOR (W. S.). **Residual Action of organic Insecticides against Stable Flies.**—*J. econ. Ent.* **42** no. 3 pp. 547–548. Menasha, Wis., 1949.

The knockdown and kill of *Stomoxys calcitrans*, L., effected by deposits of 11 organic insecticides after storage indoors and outdoors for various periods were compared in Texas in 1948. This is thought to be the first time that all these insecticides have been tested against the same pest. The materials were used as 1 per cent. solutions in acetone, in which copper-wire cages were dipped. In tests made 24 hours after treatment, during which the cages were kept indoors, DDT, methoxy-DDT (methoxychlor), bromo-DDT, parathion, DDD (dichlordiphenyldichlorethane), 95 per cent. γ BHC (benzene hexachloride), compound 118 (1,2,3,4,10,10-hexachlor-1,4,4a,5,8,8a-hexahydro-1,4,5,8-dimethanonaphthalene) [*cf. R.A.E.*, B **38** 55], a material referred to as compound 153 (the composition of which was not disclosed), heptachlor [1(or 3a),4,5,6,7,8,8-heptachlor-4 : 7-methano-3a,4,7,7a-tetrahydroindene (*cf. loc.cit.*)], toxaphene and chlordan caused complete knockdown in 8, 13, 22, 24, 25, 26, 70, 80, 113, 125 and 130 minutes, respectively. DDT and methoxy-DDT had not lost their effectiveness after seven days whether stored indoors or out. Bromo-DDT was not tested after this interval, but the other compounds took considerably longer to effect complete knockdown than they had done before, and γ BHC and parathion were much less effective after weathering outside than after storage indoors. DDT, methoxy-DDT and bromo-DDT caused complete knockdown in 14, 11 and 67 minutes after storage indoors for 14 days and in 110, 12 and 67 minutes after storage outside. All the other compounds took much longer, but all treatments still caused complete mortality within 48 hours. After weathering outside for 50 days, all cages except those treated with methoxy-DDT and bromo-DDT, which caused complete knockdown in 14 and 368 minutes, respectively, ceased to give complete kill in 48 hours. Bromo-DDT ceased to give complete kill with this exposure after storage outdoors for 126 days. Methoxy-DDT was not tested at this time owing to an error. DDD, BHC, compound 153, heptachlor and chlordan did not give complete kill in 48 hours after storage indoors for 50 days, nor did toxaphene, compound 118 and parathion after storage indoors for 126 days. After this longest exposure, DDT and bromo-DDT stored indoors were still giving complete kill in 48 hours and complete knockdown in 312 minutes and 8–24 hours, respectively.

VANDERPLANK (F. L.). **Studies of the Behaviour of the Tsetse-fly, *Glossina pallidipes*, in the Field : Influence of climatic Factors on Activity.**—*J. Anim. Ecol.* **17** no. 2 pp. 245–260, 17 refs. London, 1948.

It was considered that if the various factors that affect the activity of *Glossina* in the field could be separated and their effects measured, it would be possible to estimate the true density of the fly from a standardised catch and concurrent measurements of these factors. Standardised catches of *Glossina pallidipes*, Aust., with periodic measurements of all probable factors were therefore made at Old Shinyanga (Tanganyika Territory) from June to October 1940 and the data analysed statistically.

The following is based on the author's summary of this account of the work. The flies were caught on stationary oxen [*cf. R.A.E.*, B **33** 100], the number of males and females being recorded for every quarter-hour throughout the day, together with the air temperature, wet and dry bulb readings, light intensity, black-bulb temperature, wind velocity and barometric pressure. The catches-plus-one were converted into logarithms, and these, as an index of activity, were correlated with the climatic factors. As the catches were roughly equal when temperature and saturation deficiency were the same, irrespective of season, they are regarded as almost entirely indications of activity and not of population.

The results of correlating the catch of old males with saturation deficit in millibars for different temperature groups are given in a table. The temperature groups used were 19–25, 26–27, 28, 29, 30, 31, 32, 33, 34 and 35°C. [66·2–77, 78·8–80·6, 82·4, 84·2, 86, 87·8, 89·6, 91·4, 93·2 and 95°F.]. The correlation is positive at the lower temperatures, decreasing from 19 to 29°C., is not significant at 30°, and is negative for temperature groups above 30°, increasing with increasing temperature. All the coefficients except at 30° are significant, and all groups are significantly different from their neighbours except the two on either side of 30°. The slopes of the regressions of catch on saturation deficit are steepest at the extreme temperatures; the catch increases with the rising saturation deficit below 30°C. and decreases with the rising saturation deficit above 30°. The same effects were found when activity data were separated into humidity groups; activity increased with rising temperature up to 25 mb., but decreased with rising temperatures above this humidity. Correlations obtained with females and total catches and with catches made at different seasons and with different baits are mentioned but not given in detail since their results were very similar.

The method of measuring light intensity is described. Solar heat radiations were measured by a black-bulb thermometer in a vacuum. The comparative monthly and hourly variations of both light intensity and black-bulb temperature for the Old Shinyanga area (latitude 3° 33′S.) are given in tables, as are the mean catches of male, female and total *G. pallipides* made in 1939 for each hour of the day from 9 a.m. to 5 p.m. in the fly's "home" environment (a thicket of *Euphorbia tirucalli*) and in 1940–41 from 7 a.m. to 5 p.m. in an area outside this environment. In the home environment, the catch of females increased throughout the day, reaching its maximum between 4 and 5 p.m., whereas the male catch decreased until 3 p.m. and then increased. The trends in the other area were the same, but the catches of females fluctuated somewhat until the afternoon rise set in and the catch of males was lowest at 1 p.m. Correlations of activity with both light intensity and black-bulb temperature, in and outside the home environment, were negative and highly significant, but those with light intensity were the stronger. Experiments showed that *G. pallidipes* is active after dusk [*cf.* **30** 50], and that the flies are attracted to ultra-violet light below 3,000 Å. For each 100 per cent. increase of light intensity as measured by foot-candles there was a corresponding decrease of 20 per cent. in total numbers of *G. pallidipes* caught. These data can be used to estimate the probable catch at a given light intensity, and also explain the failure to catch this species under certain conditions.

Data are also presented on the relation of wind velocity to activity of *G. pallidipes* both inside and outside the home environment. Wind velocity up to 4·73 miles per hour was recorded outside it. The correlations were not significant. Simultaneously, observations were made on activity in relation to barometric pressure, recorded as deviations from the mean; none of the correlations was significant.

CHORLEY (J. K.). **Tsetse Fly Operations in Southern Rhodesia. Short Survey of the Situation in the Year ended December, 1946.**—*Rhod. agric. J.* **44** no. 5 pp. 520–531, 1 fldg. map; also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1419, 13 pp., 1 fldg. map. Salisbury, S. Rhod., 1947.

During 1946, the incidence of trypanosomiasis of cattle on farms in the Chipinga area of the Eastern Border of Southern Rhodesia continued the progressive decline that has been seen in recent years with the exception of 1945 [*R.A.E.*, B **37** 162, etc.]. Flies caught in Portuguese East Africa on or near the border comprised 39 examples of *Glossina pallidipes*, Aust., one of *G. brevipalpis*, Newst., and 17 of *G. morsitans*, Westw., and two of *G. morsitans* were taken on the Rhodesian side. The fact that no examples of *G. brevipalpis* or *G. pallidipes* were caught inside the border is attributed to the cutting out of some heavily forested ravines. A number of cases of trypanosomiasis of stock occurred in two mountain farms in the Melsetter district situated above the normal limit of *Glossina* infestation but connected by forest leaders with low-lying valleys on the border of Portuguese East Africa, known to be infested with *G. pallidipes* and *G. brevipalpis.* Further south, administrative difficulties and shortage of water and grazing prevented the creation of the cattle-free zone along the border authorised in the previous year [**37** 163] and the position with regard to *G. morsitans* continued to deteriorate. A very heavy infestation was found on the Ndanga River, in Portuguese East Africa, within one mile of the border, and 42 flies were taken inside Southern Rhodesia on the same river in three days. South of the Sabi River, the edge of the fly belt in Portuguese East Africa appears to have remained stationary about 20 miles from the border. Seven cases of trypanosomiasis were diagnosed from cattle near the Portuguese border just east of Umtali township. There was evidence of a small but well-established focus of *G. morsitans* near the border of Umtali and Portuguese East Africa in August, but a careful survey in November and December failed to produce any more examples.

In the Urungwe district, in the Zambesi Valley, 13 cases of sleeping sickness were diagnosed in natives, the highest number for many years. In all the northern areas covered by controlled operations for the elimination of game, densities of *G. morsitans* were further reduced. Only a few isolated foci in three areas remain to be dealt with to complete the clearing of some 10,000 sq. miles. A threat that *G. morsitans* will enter the Mtoko area from Portuguese East Africa has increased, and though it has not been seen within the area there is much more trypanosomiasis of stock. A brief account is given of the situation in individual districts and of incidental control measures taken, particular attention being devoted to the history of infestation by *G. morsitans* in the Hartley area, from which the fly has almost been exterminated.

HENNIG (W.). **Die Larvenformen der Dipteren. Eine Übersicht über die bisher bekannten Jugendstadien der zweiflügeligen Insekten. 1. Teil.** [Larval Forms in Diptera. A Review of the known immature Stages of Dipterous Insects. Part 1.]—[3+]184[+1] pp., 3 pls., 70 figs., refs. Berlin, Akademie-Verlag, 1948. Price *DM*. 22. **2. Teil.** [Part 2.]—vii+458 pp., 10 pls., 236 figs., refs. 1950. Price *DM*. 49.

These are the first two parts of a work on the morphology of the larvae and pupae of the Diptera, which is to consist in all of three parts. In the system of classification adopted by the author, the Diptera are divided into two suborders, Nematocera and Brachycera. These two parts deal with the Nematocera, the first with the Bibiomorpha and the second with the Culicomorpha. The second part thus includes mosquitos, Ceratopogonids, Simuliids and *Phlebotomus*. The morphology of Dipterous larvae and pupae and the significance of larval and pupal characters for phylogenetic classification are discussed in an introductory section. The main part of the book consists of lists of the families, with accounts of their phylogenetic status, the characters of the larvae and pupae, and their subdivisions and geographical distribution, followed by keys to the genera and lists of the species, with references to published descriptions of the larvae or pupae and indication of any parts figured in them.

Roca-Garcia (M.). **The Isolation of three neurotropic Viruses from Forest Mosquitoes in eastern Colombia.**—*J. infect. Dis.* **75** no. 2 pp. 160–169, 7 refs. Chicago, Ill., 1944.

An account is given of the properties of three infectious agents pathogenic for white mice on intracerebral inoculation that were isolated from mosquitos caught in eastern Colombia during studies on jungle yellow fever, two from pools of *Anopheles boliviensis*, Theo., and one from a pool of *Wyeomyia melanocephala*, D. & K. [*cf. R.A.E.*, B **32** 184]. They are named the *Anopheles* A, *Anopheles* B and *Wyeomyia* viruses. They could be maintained by serial passage in mouse brains. They were also infectious by intranasal inoculation, but not by intraperitoneal or subcutaneous inoculation in adult mice, though resistance against the same virus was produced in this way. The *Anopheles* B virus differed from the other two in not being infectious for baby mice on subcutaneous inoculation. No clinical disease was produced by any of the viruses in laboratory animals other than mice or in the few species of local mammals tested, but the sera of some animals developed protective power. None of the viruses produced immunity from Theiler's mouse encephalomyelitis. Cross-immunity tests showed that all three were distinct from each other and from yellow-fever virus. Neutralisation tests with the *Anopheles* A virus and immune sera for eastern and western equine encephalomyelitis, St. Louis encephalitis, Japanese B virus, West Nile virus and distemper virus also gave negative results.

Laemmert jr. (H. W.) & Hughes (T. P.). **The Virus of Ilhéus Encephalitis. Isolation, serological Specificity and Transmission.**—*J. Immunol.* **55** no. 1 pp. 61–67, 8 refs. Baltimore, Md., 1947.

Koprowski (H.) & Hughes (T. P.). **The Virus of Ilhéus Encephalitis. Physical Properties, Pathogenicity and Cultivation.**—*Op. cit.* **54** no. 4 pp. 371–385, 1 graph, 9 refs. 1946.

In the first paper, an account is given of the isolation of a new neurotropic virus (Ilhéus encephalitis virus) from mosquitos of the genera *Aëdes* and *Psorophora* taken near Ilhéus in the State of Bahia, Brazil, during attempts to isolate the virus of yellow fever, which is endemic in the region [*R.A.E.*, B **38** 91]. The new virus is lethal to mice. It was maintained through 50 serial mouse-brain passages. Serum of a rhesus monkey [*Macaca mulatta*] into which a second group of mosquitos of the same genera had been injected some weeks later protected mice against the Ilhéus virus, which was thus shown to have persisted in the locality. Serological tests showed it to differ from the viruses of eastern, western and Venezuelan equine encephalomyelitis, West Nile, Saint Louis, Japanese B and Russian spring-summer encephalitis, louping ill, lymphocytic choriomeningitis and yellow fever and from Roca-Garcia's *Anopheles* A and *Wyeomyia* viruses [see preceding abstract], and it can be clearly differentiated from his *Anopheles* B virus, as the latter is not infective for baby mice when injected subcutaneously. Theiler's mouse encephalomyelitis can be distinguished from it by the character of the pathological lesions and the symptoms produced in mice. Reasons are given for supposing it to be distinct from the Semliki forest virus [**34** 87]. It caused immunisation, so far without any sign of illness, in man. In experiments by M. B. Waddell, it was transmitted from infected to healthy baby mice by *A. serratus*, Theo., and *P. ferox*, Humboldt, which were tested because they predominated in the lots of mosquitos from which the virus was obtained, and by *A. aegypti*, L. No other species were tested.

In the second paper, which was published before the first, the results are given of laboratory investigations on the physical properties of the virus, its pathogenicity for Swiss mice, other rodents, monkeys, opossums, bats and birds, and its cultivation in tissue culture and in chick embryos. On the basis of the evidence obtained, it seems probable that it is maintained by alternate passage between marmosets (*Callithrix*) and mosquitos, with possible occasional passage through opossums or rodents.

SCHMIDT (H. W.). **Über die Artspezifität von** *Sarcoptes scabiei*. [On the Host Specificity of *S. scabiei*.]—*Zbl. Bakt.* (I. Orig.) **152** pt. 2 pp. 148–151, 8 refs. Jena, 1947.

The author has studied the mite responsible for the outbreak of sarcoptic mange on wild red foxes in Germany in 1936–44 [*cf. R.A.E.*, B **31** 16] and concludes that it is the form known as *Sarcoptes canis*, Gerl., which he considers a variety of *S. scabiei*, Deg. Two examples of the badger, *Meles meles* (*taxus*), taken in the field were found to be infested by what was apparently the same mite, and a dog that had been in close contact with an infested fox became infested and showed symptoms within 24 hours. Infestation was established in man by contact of the bare hand with an infested fox, various parts of the body other than the hands and face becoming affected. Curative measures were adopted after 11 days.

GÖNNERT (R.). **Zur Morphologie der Fleckfieber-Rickettsie in der Laus.** [Contribution to the Morphology of the Typhus Rickettsia in the Louse.]—*Zbl. Bakt.* (I. Orig.) **152** pt. 3–4 pp. 203–209, 3 figs., 16 refs. Jena, 1947.

After a brief review of the work of others on the morphology of *Rickettsia prowazeki*, the author gives detailed descriptions of unusual forms of this rickettsia found by him in the intestines of lice [*Pediculus humanus*, L.] infected by rectal injection of yolk-sac or mouse-brain cultures. They are here termed R-forms. They were particularly numerous in the first passage through the lice, but did not occur in all examples, and were found up to the eighth passage, when the observations were discontinued. They appear to be a morphological reaction of the rickettsia to cultivation in unnatural media.

PAPERS NOTICED BY TITLE ONLY.

TOBIAS (J. M.) & KOLLROS (J. J.). **Loci of Action of DDT in the Cockroach** (*Periplaneta americana*).—*Biol. Bull.* **91** no. 3 pp. 247–255, 1 fig., 11 refs. Lancaster, Pa., 1946. [See *R.A.E.*, A **38** 233.]

TOBIAS (J. M.), KOLLROS (J. J.) & SAVIT (J.). **Acetylcholine and related Substances in the Cockroach, Fly and Crayfish** [*Periplaneta americana*, L., *Musca domestica*, L., and *Cambarus*] **and the Effect of DDT.**—*J. cell. comp. Physiol.* **28** no. 2 pp. 159–182, 28 refs. Philadelphia, Pa., 1946. [See *R.A.E.*, A **38** 233.]

VINCENT (D.) & TRUHAUT (R.). **Contribution à l'étude du mécanisme de l'action physiologique de l'insecticide D.D.T. D.D.T. et cholinestérase du sérum.**—*C. R. Soc. Biol.* **141** no. 1–2 pp. 65–66, 5 refs. Paris, 1947. [See *R.A.E.*, A **38** 234.]

HASSALL (A.), DOSS (M. A.), SEGAL (D. B.) & RAY (D. H.). **Index-catalogue of Medical and Veterinary Zoology. Part 11. Authors : N to Ozzard.**—pp. 3483–3720. Washington, D.C., U.S. Dep. Agric., 1950. Price 75 *cts.* (from Supt. Documents). [*Cf. R.A.E.*, B **36** 176.]

YOUNG (M. D.) & BURGESS (R. W.). **The Transmission of *Plasmodium malariae* by** *Anopheles maculipennis freeborni.—Amer. J. trop. Med.* **27** no. 1 pp. 39–40, 8 refs. Baltimore, Md., 1947.

An experiment is described in which *Anopheles maculipennis freeborni*, Aitken, which is believed to be the main vector of malaria on the west coast of the United States [*cf. R.A.E.*, B **36** 194, etc.], became infected with *Plasmodium malariae* and transmitted it, as did *A. quadrimaculatus*, Say, which was included in the test as a control [*cf.* **21** 182 ; **24** 110]. Of 37 females of *A. m. freeborni* dissected and 44 of *A. quadrimaculatus*, Say, 5 and 9, respectively, had become infected, and averages of 2 and 2·2 oöcysts per gut were seen. After being kept at 75°F. for 32 days, three females of each species bit test subjects, both of whom became infected. The average intensity of sporozoite infection in the glands lay in the 100–999 group for *A. m. freeborni* and in the 1–9 group for *A. quadrimaculatus* [*cf.* **36** 216].

COWAN (F. A.), MCGREGOR (T.) & RANDOLPH (N. M.). **DDT Dust for the Control of Head Lice.**—*Amer. J. trop. Med.* **27** no. 1 pp. 67–68. Baltimore, Md., 1947.

On the basis of an investigation made in Texas early in 1946, treating the hair with 10 per cent. DDT dust at 3–5 gm. per head and leaving it in for one week is recommended for the control of *Pediculus humanus capitis*, Deg. The study was made on 246 children of whom 57 had no infestation at the outset and 100, 54 and 35 had light, medium and heavy infestations, respectively. Most of them lived under crowded conditions. A dust containing 10 per cent. DDT in pyrophyllite was applied with a shaker and rubbed or patted into the hair of 173 of the children, who were instructed not to wash their hair for one week. After two weeks, 107 received a second application. Members of each infestation group were included in each treatment group and the controls. Examination four weeks after the initial treatment showed that both one and two applications had been completely effective. Only one child, who had received one application, had a light infestation, and he admitted having washed his hair on the day after treatment. Infestation remained fairly constant in the control group. No harmful results from the use of the dust were noted. No child with scalp abrasions was dusted.

BLOCK (S. S.). **Residual Toxicity Tests on insecticidal protective Coatings.**—*Soap & sanit. Chem.* **24** no. 4 pp. 155, 157, 159, 161, 207, 213, 3 figs., 13 refs. New York, N.Y., 1948.

Experiments by the author have shown that the toxicity to house-flies [*Musca domestica*, L.] of surface coatings containing DDT tends to increase with time [*R.A.E.*, B **38** 67], and Gilmour has noted a similar increase [**35** 132]. The aspects of the author's work that demonstrate this increase in toxicity as the coating ages are set out, and the possible mechanism of the phenomenon and its practical significance are discussed. It was first observed when a cellulose-acetate lacquer containing 20 per cent. DDT by weight was being tested. The periods required for 50 per cent. knockdown two days and one and three weeks after application were about 145, 70 and 20 minutes, respectively. DDT became visible as a light dust about one month after application, and maximum speed of knockdown (in rather less than 20 minutes) was attained at this time and maintained for over a year. Serial testing of other types of coatings containing DDT and less extensively of coatings containing γ benzene hexachloride, chlordan, toxaphene or pyrethrum demonstrated the occurrence of the same phenomenon to a greater or less extent. The results are given in tables.

Formation of DDT crystals on the surface upon ageing was demonstrated in several types of coating, but was best seen in one composed of asphalt varnish (gilsonite) and 20 per cent. DDT. When it was first applied and subsequently after wiping, its surface was black, but within a few days of application and 3–4 days of wiping, the DDT crystals, which appeared as a white dust, could be clearly seen. Even after several months and repeated wiping, the crystals reappeared at the surface within a few days. Knockdown times were correlated with the removal and reappearance of the crystals. The continued deposition of crystals at the surface of the coating is attributed to slow precipitation from a supersaturated solution of the insecticide in the paint vehicle, analogous to the " blooming ", due to formation of sulphur crystals, that sometimes occurs on the surface of vulcanised rubber. If crystallisation takes place throughout the coating, no further deposition at the surface is seen. The mechanism of increasing toxicity in the case of casein paint in which DDT is in suspension and in paracoumarone-indene coating are also, but much more briefly, discussed. In the latter, no crystallisation was seen, even after a year, except in films containing more than 50 per cent. DDT, and adsorption at the surface is tentatively suggested.

It is believed that, in practice, coatings in which the incorporated insecticide migrates to the surface would act as reservoirs to replace the insecticide that is lost by dusting off and volatilisation and keep the surface toxic to insects for long periods. For materials such as asphalt that throw out a considerable quantity of the insecticide in a short time, the incorporation of a plasticiser having a high solubility for the insecticide and low volatility is suggested. To be a good vehicle for an insecticide, a coating should have a low solubility for it and be able to hold a considerable amount in metastable solution. The quantity of insecticide in the coating required to give the maximum deposit on the surface by migration may be very critical. If too little is used, the quantity deposited will be reduced. If more is used than the vehicle can maintain in metastable solution, crystallisation will occur throughout the coating upon evaporation of the solvent, with a consequent decrease in migration to the surface.

GIROUD (P.) & CIACCIO (G.). **Essais d'inoculation de *Rickettsia prowazeki* chez les insectes. Conservation de la virulence pour le cobaye après passage par chrysalides de *Bombyx mori* et chenilles de *Tenebrio molitor*.**—*C. R. Soc. Biol.* **141** nos. 1–2 pp. 17–19, 3 refs. Paris, 1947.

Suspensions of rabbit lung infected with *Rickettsia prowazeki* were injected into the body cavity of 22 pupae of *Bombyx mori*, L., and 43 larvae of *Tenebrio molitor*, L. Six of the pupae of *B. mori* gave rise to adults. The infection was shown by injection into guineapigs of two adults of *B. mori* crushed together with their eggs and of larvae of *T. molitor* to have survived for 12 days in the former species and up to 33 days in the latter.

PRILL (E. A.), SYNERHOLM (M. E.) & HARTZELL (A.). **Some Compounds related to the Insecticide " DDT " and their Effectiveness against Mosquito Larvae and Houseflies.**—*Contr. Boyce Thompson Inst.* **14** no. 6 pp. 341–353, 40 refs. Menasha, Wis., 1946.

Data are given on the preparation, characters and effectiveness of diphenyltrichlorethane and 31 analogues of it (in which all substituents were on the rings) that were synthesised at Boyce Thompson Institute and tested against *Musca domestica*, L., and larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.). Ten of the analogues were also converted to their dehydrochlorination products and tested.

The most effective against the mosquito larvae were the symmetrically 4,4′-disubstituted analogues in which both substituents were chlorine (DDT), fluorine, methyl, methoxyl or ethoxyl [*cf.* *R.A.E.*, B **33** 120] and also the 4-chlor-4′-methyl, 4-methoxy-4′-ethoxy and 3,4-methylenedioxy-4′-methoxy unsymmetrical analogues. On the basis of the tests, it was not possible to establish the relative order of effectiveness of these most active analogues to mosquito larvae. Somewhat less active mono- and disubstituted analogues were the 4-chlor, 4,4′-dibromo, 4,4′-diiodo, and 4,4′-di-n-propoxy analogues. The activity of disubstituted analogues having methoxyl or ethoxyl substituents in the 4,4′ positions was reduced when they were further substituted in the 3,3′ positions by methyl groups or chlorine atoms. This was true in the tests against house-flies as well as in those against mosquito larvae. The substituted analogues that contained no substituent in either the 4 or 4′ position were inactive. Dichlordiphenyldichlorethylene, the dehydrochlorination product of DDT, was about one-tenth as active against mosquito larvae as its parent compound. This relationship also held in the case of the dehydrochlorination product of the unsubstituted diphenyltrichlorethane. The dehydrochlorination product of the 4,4′-dimethoxy analogue showed no activity.

Tests against *M. domestica* were made by the large-group Peet-Grady method [**37** 5, 89, etc.] with solutions in refined kerosene, sometimes with the addition of a little acetone and usually with a small amount of added knockdown agent. The unsubstituted diphenyltrichlorethane was only slightly active towards the flies when used at a concentration of 2 gm. per 100 ml. The analogues that were effective in about the same range as DDT in the tests on mosquito larvae were also effective in the tests on house-flies ; certain differences, however, in respect to type or degree of effectiveness were apparent in the latter tests. The 4,4′-difluoro analogue has the advantage of being liquid, but it did not show so great a killing power as DDT. The 4,4′-dibromo analogue appeared almost as active as DDT, but the 4,4′-diiodo analogue was much less active. The 4,4′-dimethyl, the 4-chlor and the 4-chlor-4′-methyl analogues were only moderately active. The 4,4′-dimethoxy analogue gives good knockdown [*cf.* **33** 120], but its killing power is considerably less than that of DDT. The 4,4′-diethoxy analogue has about two-thirds the lethal power of DDT and a knockdown ability better than that of DDT, although inferior to that of the dimethoxy compound. The 3,4-methylenedioxy-4′-methoxy analogue was found to be of considerably greater effectiveness against house-flies than DDT in respect to both knockdown and kill. It is well known that certain compounds containing a methylenedioxyphenyl radical in their structure, though not all, are active as insecticides and particularly as synergists with pyrethrum [*cf.* **35** 186 ; **37** 159–161, etc.]. The synergism with pyrethrins did not appear in the 3,4-methylenedioxy-4′-methoxy analogue. The dehydrochlorination products tested against house-flies showed no activity against them.

SEDDON (H. R.). **A Review of communicable Diseases of Animals in Australia. With Indications of their economic Importance, Distribution and Incidence in 1946–47.**—*Serv. Publ.* (*Div. vet. Hyg.*) *Dep. Hlth Aust.* no. 3, 33 pp., 4 fldg. maps. Canberra, 1948.

The communicable diseases of domestic animals in Australia dealt with in the main part of this publication comprise conditions due to infestation by Helminths or Arthropods as well as diseases caused by viruses, protozoa and bacteria and three diseases of doubtful aetiology. The States in which each disease or parasite is scheduled (declared a disease under stock disease control legislation, though it may not necessarily occur there) and the States in which they are known to occur are indicated. Known or probable Arthropod vectors are recorded for some of the diseases of cattle and fowls. The diseases of fowls are fowl pox, probably not uncommonly transmitted by mosquitos, spirochaetosis, caused by *Spirochaeta* (*Treponema*) *anserina*, which is transmitted by *Argas persicus*, Oken, and sometimes by *Dermanyssus gallinae*, Deg., and also occurs in ducks, and the eye worm (*Oxyspirura mansoni*) of which the intermediate host is the cockroach, *Pycnoscelus surinamensis*, L. The important tick-borne diseases of cattle are anaplasmosis, caused by *Anaplasma marginale* and piroplasmosis, caused by *Piroplasma* (*Babesia*) *bigeminum* and *P.* (*Babesiella*) *argentinum*, all transmitted by *Boophilus annulatus microplus*, Can. *Theileria mutans*, probably carried by *Boophilus*, *Haemaphysalis bispinosa*, Neum., and *H. bancrofti*, Warb. & Nutt., is widespread in the blood of cattle but is not found to have any pathogenic significance in Australia. Ephemeral fever became epizootic in cattle over a wide area in 1936–37, and Ceratopogonids have been suggested as likely vectors [*R.A.E.*, B **29** 188–189]. Only isolated cases have occurred since 1940. *Onchocerca gibsoni* occurs in cattle in widely separated areas ; the intermediate host is almost certainly some Simuliid or Ceratopogonid.

The Arthropod parasites other than those mentioned above are *Damalinia ovis*, L., *Linognathus pedalis*, Osb., *L. ovillus*, Neum., *Melophagus ovinus*, L., *Psorergates ovis*, Womersley, and *Lucilia cuprina*, Wied., all on sheep, *Echidnophaga gallinacea*, Westw., which is mainly a pest of fowls, but is also found commonly on dogs, cats and horses and sometimes on ducks, goats and cattle, *Siphona exigua*, de Meij., attacking cattle, and *Ixodes holocyclus*, Neum., which is of importance because it causes tick paralysis in various domestic animals. Four maps are appended, two of which show the distribution of *S. exigua* and *B. a. microplus*, respectively.

The territory of Papua and New Guinea is dealt with in an appendix. A list is given of diseases found there by Japanese officers in domestic animals, mostly of Japanese origin, including several in New Britain and Bougainville during the Japanese occupation, and another of the most important communicable diseases of domestic animals and Arthropods infesting them found by an Australian veterinary mission that visited Papua and New Guinea in 1945–46. The Arthropods are *S. exigua* and *B. a. microplus*.

As the object of the publication is to give a list of diseases of importance to any country seeking to import stock or animal products from Australia, diseases due to soil infections are not included. A list is given of the most important parasites and highly infectious diseases of stock that do not occur in Australia.

HSIAO (Tsai-Yu) & BOHART (R. M.). **The Mosquitoes of Japan and their medical Importance.**—*Navmed* no. 1095, [2+]44 pp., 3 pls., 58 refs. Washington, D. C., Navy Dep., Bur. Med. Surg., 1946.

This paper is intended to provide a general synopsis of knowledge on the mosquitos of Japan. The area treated comprises the main Japanese Islands and the Bonin Group. The mosquito fauna is predominantly Palaearctic with some Oriental species. Keys are given to the adults of the 44 species, and the larvae where known, together with notes on distribution, bionomics and, where appropriate, relation to disease and taxonomic position. Material of 35 species and Japanese specimens of 23 were studied. Other information is from the literature. Four of the species were originally described in Japanese, and redescriptions of these based on the originals are included. A few species appear to be restricted to one or more of the main islands, but most occur also in China, Korea or the Soviet Far East. The Anophelines, none of which is recorded from the Bonin Islands, are *Anopheles hyrcanus* var. *sinensis*, Wied., which is the only one known to be of importance in the transmission of malaria and which the authors treat as an independent species on the ground that the identity of the typical *A. hyrcanus*, Pall., is in doubt, *A. sineroides*, Yamada, *A. koreicus*, Yamada & Watanabe, *A. edwardsi*, Yamada, *A. lindesayi* var. *japonicus*, Yamada, and *A. insulaeflorum*, Sw. & Sw. de G. There is some evidence that *A. edwardsi* is a cold-water or seasonal form of *A. koreicus* [though Maslov regarded it as a colour form of *A. h. sinensis* (*R.A.E.*, B **36** 79)]. The costal markings of the wing are strikingly different in typical examples of *koreicus* and *edwardsi*, but the authors examined a series of 57 specimens from Honshu and found that 35 were *edwardsi*, 15 were *koreicus* and seven were intermediate in wing pattern, several having one wing simulating *edwardsi* and the other *koreicus*.

Notes are also given on the mosquito-borne diseases of Japan. These are filariasis caused by *Filaria* (*Wuchereria*) *bancrofti*, Japanese B encephalitis, malaria (the only endemic type being that caused by *Plasmodium vivax*) and dengue. Two cases of yellow fever were reported in 1927 and one in 1937 but were probably not indigenous.

FLOCH (H.) & ABONNENC (E.). **Poissons larvivores de la Guyane française.**—*Publ. Inst. Pasteur Guyane* no. 132, 6 pp., 11 figs. Cayenne, 1946.

A collection of nearly 2,000 small fish from ponds, streams, wells, etc., in the neighbourhood of Cayenne was found to comprise 11 species. The number of each taken and place of capture are shown in a table, and brief notes are given on the distinguishing characters of most of the species, nearly all of which are figured, and on the habits and capacity for consuming mosquito larvae of those taken in sufficient numbers. The most numerous were *Hemigrammus rodwayi*, *Poecilia vivipara* and *H. unilineatus*, of which 682, 523 and 352, respectively, were identified. The first two occur in both fresh and brackish water and the last was found in fresh water only. On several occasions, ten individuals of *H. rodwayi* that had not fed for 48 hours consumed 50 larvae of *C[ulex] coronator*, D. & K., in less than a minute. *H. unilineatus* was equally voracious. *P. vivipara* was slightly less so, but it is considered the most useful species for local domestic mosquito control because of the ease with which it adapts itself to water of different types and to small containers.

FLOCH (H.) & ABONNENC (E.). **Simulidés de la Guadeloupe :** *S. antillarum* **Jennings et** *S. tarsale* **Williston.**—*Publ. Inst. Pasteur Guyane* no. 130, 6 pp., 2 figs., 5 refs. Cayenne, 1946. **Simulidés de la Guyane française I.** *S. guianense* **Wise 1911,** *S. rorotaense* **n. sp.,** *S. maroniense* **n. sp.**—*Op. cit.* no. 136, 20 pp., 10 figs., 6 refs. (**II**). *S. cauchense* **n. sp.,** *S. oyapockense* **n. sp.,** *S. iracouboense* **n. sp.**—*Op. cit.* no. 137, 19 pp., 6 figs., 9 refs.

In the first paper, descriptions are given of the females of *Simulium antillarum*, Jennings, and *S. tarsale*, Will., both of which attack man viciously in Guadeloupe. The former is very abundant in Basse Terre and bites in open country, particularly in the morning. The latter, which is much scarcer, occurs in Guadeloupe and St. Vincent.

In the second paper, a figure of the female of *S. tarsale* is included, and it is stated that a figure of *S. guianense*, Wise, was erroneously given instead of one of *S. tarsale* in the first. The adults of both sexes and pupa of *S. guianense* and *S. rorotaense*, sp. n., and the female and pupa of *S. maroniense*, sp. n., are described from French Guiana. The first two were taken biting man. The male of *S. maroniense* is indistinguishable from that of *S. rorotaense*.

The three new species of *Simulium* that are the subject of the third paper were taken in French Guiana as pupae and are described from these and from adults of both sexes reared from them.

LaMer (V. K.) & others. **The Influence of the Particle Size of homogeneous insecticidal Aerosols on the Mortality of Mosquitoes in confined Atmospheres.**—*J. colloid Sci.* **2** (1947) no. 6 pp. 539–549, 2 graphs, refs. New York, N.Y., 1948.

The results obtained in exploratory tests in November 1943, in which DDT was added to the oil supply in a military screening smoke generator and the aerosol cloud so created was drifted through woodland areas heavily infested with *Aëdes taeniorhynchus*, Wied., were deemed to warrant further study of the method. Since liquefied gas aerosols in common use for the control of mosquitos in enclosed atmospheres were known to be composed of particles having a wide size range up to 20–30 μ in diameter with average diameters of 10–20 μ, whereas screening smokes are composed of much smaller particles, usually less than 1 μ in diameter, laboratory studies were undertaken to ascertain the minimum particle size that would be effective. Preliminary tests on *Drosophila* showed that much larger particles than those produced by the screening smoke generators would be necessary, and a large-scale generator using the principle of thermal generation by means of steam was eventually developed by LaMer & Hochberg [*cf. R.A.E.*, B **35** 128]. In laboratory tests at Beltsville, Maryland, in January 1944, in which specially developed apparatus for the generation of homogeneous aerosols of DDT in oil and instruments and methods for measuring the particle size and concentration were used, the toxicity to *A. aegypti*, L., in confined atmospheres of aerosols having particles of different sizes was studied. The apparatus, which was devised by LaMer & D. Sinclair, was all glass, and the temperature did not exceed 230°C. Under these conditions, the DDT did not decompose. The mortality of female mosquitos caused by exposure to the aerosols is given in a table. The following is taken from the authors' summary of the results. Exposures of 10–30 minutes in aerosol concentrations of about 100 mmg. per litre were necessary to produce high mortalities when particles 1 μ or less in diameter were used. Exposure of 0·5–2 minutes in aerosol concentrations of about 25 mmg. per litre produced high mortality when particles were 5–16 μ in diameter. When the values for Ct (concentration in mmg. of oil containing approximately 8 per cent. DDT multiplied by time of exposure in minutes) that produced 50 per cent. mortality were plotted against particle size, toxicity was shown to be increased by 250 or more times by increasing the diameter of the particle from 0·33 to 11 μ. This curve corresponded to a curve in which the time necessary for the aerosol to settle out of 1 cc. is plotted against particle size, as calculated according to Stokes' Law and Cunningham's correction. It also showed that the toxicity is proportional to the rate of deposition, which, in turn, is proportional to the square of the radius (or diameter) of the aerosol particle for the sizes discussed.

Latta (R.) & others. **The Effect of Particle Size and Velocity of Movement of DDT Aerosols in a Wind Tunnel on the Mortality of Mosquitoes.**—*J. Wash. Acad. Sci.* **37** no. 11 pp. 397–407, 6 figs., refs. Menasha, Wis., 1947.

An account is given of further work at Beltsville, Maryland, on the influence of particle size on the effectiveness of DDT aerosols against mosquitos [*cf.* preceding abstract]. In the studies here described, which were made from January to May 1945, wire-gauze cages containing adults of *Aëdes aegypti*, L., were exposed to aerosols of DDT in oil of uniform and known particle size moving through a wind tunnel at 2, 4, 8 or 16 miles per hour. The diameter of the droplets ranged from 1·12 to 20·4 μ. The wind tunnel and the experimental technique are described. The mortality of female mosquitos caused by aerosols of different particle sizes at the different velocities and the amount of

DDT needed to cause 50 per cent. mortality for 15 particle sizes and the four wind speeds are shown in tables. It was found that the quantity of DDT that must pass through a given cross-sectional area of the tunnel to kill 50 per cent. of the females depends on the rate of deposition and is a simple function of D^2v (the product of the square of the diameter of the droplets and the wind velocity). For small values of D^2v, when only a small fraction of the particles is deposited on the insects in their path, the quantity required is inversely proportional to D^2v. Effectiveness increases with increase in particle size or velocity until practically all particles are deposited on an insect in their path. Thereafter, further increase in particle size or velocity is ineffective. The approximate amount of DDT that should be deposited on a female of *A. aegypti* of median susceptibility to cause death was estimated to be 0·03 mmg. This quantity is contained in a single particle of a 10 per cent. solution 83 μ in diameter, or in one of pure DDT 34 μ in diameter.

YEOMANS (A. H.), ROGERS (E. E.) & BALL (W. H.). **Deposition of Aerosol Particles.**—*J. econ. Ent.* **42** no. 4 pp. 591–596, 1 fig., 5 refs. Menasha, Wis., 1949.

In this further paper on work on insecticidal aerosols at Beltsville, Maryland [*cf.* the two preceding abstracts], data on the deposition of aerosol particles on various objects in still and in moving air are discussed. Though many believe that in enclosed spaces, toxic deposits are left on vertical surfaces, certain physical laws indicate that particles of the sizes usual in insecticidal aerosols should settle straight down unless diverted by some force greater than gravity. This movement towards the earth is resisted by molecules of air. When the diameter of the particles is greater than the distance between the molecules of air, there is uniform resistance due to the bombardment of the molecules and the particles fall straight down. The rate of fall of particles with diameters between 1 and 200 μ under standard conditions can be calculated by Stokes' law. Factors that can overcome gravity and divert the particles include temperature gradients, wherein very small particles move towards a cold surface ; light rays, in which small particles are repelled ; air currents, including sound waves ; electrical fields, wherein particles are drawn towards the opposite pole ; and Brownian movement, in which a particle with a diameter less than the distance between the molecules of the air (less than 0·1 μ in air at 70°F.) changes direction while falling owing to the bombardment of the air molecules from various directions.

Tests were made with DDT aerosols released in enclosures to determine the relative amounts deposited on horizontal and vertical surfaces. In work by O. C. McBride and W. N. Sullivan, insects did not die when confined on panels that had been exposed on walls to aerosols, but mortality amongst insects on panels that had been exposed to the same aerosol on the floor was as high as 94 per cent. When deposits on aluminium plates were analysed chemically, the amount of DDT recovered from wall panels was less than 1 per cent. of that on the floor panels. Examination of deposits of aerosols containing dyes and measurement and counting of deposited particles indicated that in general, where aerosols are applied within enclosures, there is little or no deposition on walls or other vertical surfaces, and the particles settle almost entirely on the top of horizontal surfaces, though the settling deviates from the perpendicular, probably because of slight convection currents, as evidenced by deposits within a cube with two open sides and in a horizontal cylinder.

Experiments were carried out to determine whether deposition of aerosol particles in moving air would be in accordance with the behaviour of liquid particles of other types. In 1931, W. Sell [*Forschungsh. Ver. dtsch. Ing.* no. 347] showed that particles in a moving current of air, in addition to settling out, deposit selectively on the surfaces perpendicular to the air flow. Suspended particles tend to resist deflection by an object in the way of the air stream and the probability of their striking the object varies directly with the square of their diameter and their velocity and inversely with the size of the object. It also varies to some extent with the shape of the object. Sell developed a formula to express the efficiency of deposition of oil particles on objects of various shapes. This efficiency is shown to vary according to a value δ that can be computed by using standard conversion factors: $\delta = 0{\cdot}00005\ D^2V/S$ where S=size (greatest width) of the object in inches, D=diameter of the particle in μ and V=velocity in miles per hour. The efficiency is greatest when $\delta = 1$. The results of the work in which mosquitos were exposed to moving particles [see preceding abstract] agree with this, the optimum particle diameter for a mosquito in a 2 m.p.h. wind being indicated to be about 12 μ, whereas the value calculated by Sell's formula for a mosquito 0·025 inch in width, flying in an aerosol cloud at this speed, is 15·81. In tests made with house-flies [*Musca domestica*, L.], it was found that the optimum particle size for a fly in motion at 4 miles per hour (the calculated speed of flight) was about 22·4 μ. This is also the optimum particle size according to Sell's formula on the assumption that a fly is 0·1 inch in diameter.

Deposition on disks of wire cloth, glass, filter paper and leaves was measured by exposing them in a vertical position in a wind tunnel to aerosol clouds moving at 2–16 m.p.h. The experimental methods are described. The deposits on the various surfaces with particles of different sizes travelling at different velocities are shown in a table, the D^2V values are given for reference and the expected efficiency of deposition as calculated from Sell's formula is also given for comparison. The agreement between the actual efficiency of deposition and that predicted by Sell's formula was very good. The predicted efficiency was higher than the actual efficiency when the deposit was low. The test disks also received a deposit on the back, a factor not considered by Sell. The larger particles tended to be deposited on the front of the disks and the smaller ones on the back. The division point was apparently a function of the velocity of movement and perhaps of the character or thickness of the disk. The division point appeared to be near a particle size of 15 microns diameter at 8 m.p.h. and about 22 microns at 16 m.p.h.

REES (B. E.), RALEY (T. G.) & DAVIS (E. D.). **Pre-hatching Treatment of irrigated Lands with DDT, Dichlorodiphenyl Dichloroethane, and Gamma-Benzene Hexachloride for Control of Flood-water Mosquitoes.**—*J. econ. Ent.* **42** no. 4 pp. 586–590. Menasha, Wis., 1949.

The following is mainly based on the authors' summary. Pre-hatching treatment with sprays of emulsified solutions of DDT and DDD (dichlordiphenyldichlorethane) and a suspension of a wettable powder mixture of pure γ BHC (benzene hexachloride) in inert material was used both experimentally and on a practical basis for the control of *Aëdes* mosquitos in 1947 and 1948 on irrigated lands in California, where the life-cycle is often as short as four days. DDT and DDD, applied at 1·2 lb. and 1·18 lb. toxic ingredient per acre, respectively, gave equal and effective larval control for 1–3 months or a maximum of six floodings, depending on the irrigation cycle. The average effective control period was six weeks or the equivalent of three floodings. Practically no larvae were found four days after treatment. The γ BHC was applied at 0·03 lb. pure isomer per acre and was ineffective. The low rate was made necessary by the presence of livestock. Observations indicated that γ BHC would prove as effective as DDT or DDD if it were applied in the same or even somewhat smaller amounts. All insecticides were applied to the ground or to the vegetation as near the ground as possible, in order to make them available for mixing with the propagating water upon irrigation or flooding. Tall and dense vegetation and pools of standing water decreased the efficiency of pre-hatching treatment, but experiments with DDD at 0·54 lb. per acre showed that as an alternative, application of the insecticide to such vegetation gave good control of emerging adults. The average number settling on a given area of clothing was reduced from 45–75 in four plots the day before spraying to 1–5 the day after spraying. Three applications during July on one plot resulted in satisfactory control by the end of the month, and all insecticidal applications were stopped.

No detrimental effects were observed on vegetation or the feeding livestock due to the treatment of the fields with DDT, DDD or BHC. The treatment of dry rather than wet land resulted in increased operational efficiency and reduced damage to field and dikes to a minimum. Further study of the method is necessary, particularly in different localities and under different conditions from those concerned in this work, but the results obtained are deemed to warrant its continued and extended use.

McGregor (W. S.). **Field Tests of Insecticides and Spraying Methods to control Horn Flies in Dairy Herds.**—*J. econ. Ent.* **42** no. 4 pp. 641–643, 3 refs. Menasha, Wis., 1949.

Following the successful use in 1947 of chlorinated hydrocarbon insecticides against *Siphona irritans*, L. at Kerrville, Texas [*R.A.E.*, B **38** 32, 84] and in Kansas and Missouri [**38** 54], further experiments were carried out on 16 dairy herds in Texas in 1948. DDT, methoxy-DDT (methoxychlor), DDD (dichlordiphenyldichlorethane) and toxaphene were compared. Each was prepared as an emulsion concentrate containing 25 per cent. insecticide, 65 per cent. xylene and 10 per cent. Triton X-100, which was diluted to give a concentration of 0·5 per cent. insecticide. The cattle received either 1 or 2 U.S. quarts spray (4·75 or 9·5 gm. insecticide) over the whole body or 1 U.S. quart over the dorsal or ventral part only, at a pressure of 200 lb. per sq. inch. Treatments were begun in June and repeated when populations built up to 25 per animal until frost terminated fly activity in November.

Drought conditions unfavourable to *S. irritans* caused considerable variation in the results. However, records made during periods of weather favourable to the fly were in agreement with the results obtained in Texas during 1947. The performances of the four insecticides were similar, all giving complete immediate control, and duration of protection was about the same whether 1 or 2 U.S. quarts were applied to the whole body or 1 U.S. quart to the dorsal part. When the undersides only were sprayed, the period of protection was usually shortened.

Howell (D. E.), Eddy (G. W.) & Cuff (R. L.). **Effect on Horse Fly Populations of Aerial Spray Applications to wooded Areas.**—*J. econ. Ent.* **42** no. 4 pp. 644–646. Menasha, Wis., 1949.

To examine the effect on populations of Tabanids of spraying wooded areas from aircraft, five 10-acre plots and one 60-acre plot in Oklahoma were treated in August, 1948, with methoxy-DDT (methoxychlor), DDT, toxaphene or chlordan at 2 lb. per acre as 10 per cent. solutions in a mixture of cyclohexanone and fuel oil. Effectiveness was determined by counting the flies attacking horses led through the test and control plots on the day before spraying and 1–7 days after it. The results were somewhat erratic, and no appreciable effect could be attributed to any of the insecticides. *Tabanus abactor*, Philip, and *T. sulcifrons*, Macq., were the most abundant species represented.

Laake (E. W.), Brundrett (H. M.) & Babcock (O. G.). **Screw-worm Survey in western United States, 1948.**—*J. econ. Ent.* **42** no. 4 pp. 684–685. Menasha, Wis., 1949.

Surveys of populations of *Callitroga hominivorax*, Coq. (*americana*, Cush. & Patt.) in the western United States [*cf. R.A.E.*, B **33** 23] in 1948 were begun in March to determine the areas of Texas and Arizona in which it lived through the winter. These were found to be limited to not more than ten counties in the extreme south of Texas and parts of four in Arizona [*cf.* **34** 81–82]. The cold, dry winter had been most unfavourable. Survival through the winter rarely occurs in other States west of the Mississippi, with the possible exception of California. Later in the season, the survey was extended to New Mexico, Oklahoma, Louisiana, Arkansas, Kansas, Missouri, Nebraska, Iowa and Illinois. Migration was in progress in April and early May but was 2–3 weeks later than normal ; by mid-summer, the fly had spread in this way to all the States mentioned except the last four, where its occurrence was undoubtedly due to importation of infested animals. Early infestations were also begun in Kansas through importation. No serious infestations developed in 1948 in any of the affected western States from infestations imported early in the season, because control measures were instituted immediately. Infestation in the area as a whole was very low. This was attributed to prolonged drought, prompt treatment with Smear 62 [*cf.* **30** 195] and possibly the use of chlorinated hydrocarbons against other pests.

Travis (B. V.), Morton (F. A.), Jones (H. A.) & Robinson (J. H.). **The more effective Mosquito Repellents tested at the Orlando, Fla., Laboratory, 1942–47.**—*J. econ. Ent.* **42** no. 4 pp. 686–694, 2 refs. Menasha, Wis., 1949.

In preliminary investigations in Florida, 4,308 chemicals were tested for application to the skin as mosquito repellents. All were tried against *Aëdes aegypti*, L., and most against *Anopheles quadrimaculatus*, Say, also. The method used was adapted from that described by Granett [*R.A.E.*, B **29** 65], both paired and unpaired tests being made, with dimethyl phthalate as the standard for the former. Detailed data are given of the performance against both species of 59 compounds that protected for five hours or more against *Aëdes*, and also a list of 303 that gave protection for 3–5 hours against *Aëdes*, showing for both species whether they were repellent for a longer or shorter time than dimethyl phthalate. Against *Aëdes*, 117 of the 303 protected for longer than dimethyl phthalate and 71 of the 106 included in the paired tests were superior by this method also. Against *Anopheles*, only 18 of the materials had an average protection time greater than dimethyl phthalate in unpaired tests and only seven of these were also superior to it in paired tests. The average repellent times for dimethyl phthalate in 202 paired tests with *Aëdes aegypti* ranged from 171 to 442 minutes and in 216 paired tests with *Anopheles quadrimaculatus* from 46 to 385 minutes.

Of the materials effective for at least five hours against *Aëdes aegypti*, 25 gave longer protection than 2-ethyl-1,3-hexanediol, the most effective of the standard repellents for this mosquito, which had an average protection period of 331 minutes. Those that were effective for more than six hours were N-n-amyl acetanilide, 2,5-endomethylene-6-methylhexahydrobenzyl diethylene glycol ether, 2-nitro-2-ethyl-1,3-propanediol crotonaldehyde acetal, 2-phenylcyclohexanol, N-n-propyl-1,2,3,6-tetrahydrophthalimide and 1,2,3,4-tetrahydro-2-naphthol. Against *Anopheles quadrimaculatus* in unpaired tests, only N-n-amyl succinimide, 2,5-endomethylene-6-methylhexahydrobenzyl diethylene glycol ether, 1-phenylcyclohexene-2-ol-1 and n-undecylenic acid were more effective than dimethyl phthalate, which is the best standard repellent against this species and had a protection time of 112 minutes. In paired tests, 3 of 44 compounds were indicated to be more effective than dimethyl phthalate, but they had shorter average protection times. The chemical class to which each compound belonged is indicated. The classes containing the highest percentages of the effective materials were esters, nitrogen compounds (chiefly amides and imides), ethers and alcohols. The results obtained were very variable.

CARSON (N. B.) & EDDY (G. W.). **Preliminary Evaluation of Materials as Synergists with Pyrethrum against the Body Louse.**—*J. econ. Ent.* **42** no. 4 pp. 694–699, 3 refs. Menasha, Wis., 1949.

In further extensive work [*cf. R.A.E.*, B **33** 109], 446 compounds were investigated as potential synergists for pyrethrum in the control of *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.). Preliminary tests were made by the beaker method [**34** 44–45], with 20 lice per beaker, using solutions containing 0·25 per cent. of the test substance and 0·025 per cent. pyrethrins prepared from a 20 per cent. concentrate. This concentration of pyrethrins alone usually had negligible toxicity. Combinations causing at least 80 per cent. mortality in 24 hours were retested at half strength, and the best of these again at 0·05 per cent. synergist and 0·005 per cent. pyrethrins. The materials that, with pyrethrins, caused at least 50 per cent. mortality at the lowest concentration were tested alone at all three, but few possessed much individual toxicity.

The results obtained with the 23 compounds that significantly increased the toxicity of pyrethrins are shown in a table. The combinations made with 20 of them caused complete mortality of lice at the highest concentration, but 12 of the compounds were toxic when tested alone. At the next concentration, 17 compounds killed all lice with pyrethrins and only two caused any mortality when alone. At the lowest concentration, all 23 materials caused 50–100 per cent. mortality of lice with pyrethrins and none caused any mortality alone. The most effective synergists as indicated by these tests are stated to be the diallyl ester of *d*-camphoric acid, N-isobutylundecyleneamide (IN-930), the ethyl ester of 3,4-methylenedioxycinnamic acid, the n-amyl ester of piperonylic acid, piperonyl cyclonene, 1-(3,4-methylenedioxyphenyl)-1-acetoxybutene-3, and the di-n-butyl ester of piperonylidenemalonic acid. Lists are given of materials that showed slight or questionable synergism, of which there were about 90, and of those that showed no synergism at the highest concentration.

Lasting properties were evaluated by the arm-and-leg method [**33** 109], using powders containing 2 per cent. synergist and 0·2 per cent. pyrethrins. The di-n-butyl ester of piperonylidenemalonic acid and piperonyl cyclonene proved more effective than IN-930 [*cf.* **34** 45], and six other compounds compared favourably with it in lasting effect. These were the diethyl ester of piperonylidenemalonic acid ; the di-n-butyl ester of hexahydrophthalic acid ; 1-(3,4-methylenedioxyphenyl)-1-acetoxybutene-3 ; the di(2-ethylhexyl) ester of cis-3,6-endomethylene-1,2,3,6-tetrahydrophthalic acid ; the ethyl ester of 3,4-methylene-dioxycinnamic acid ; and isosafrole. The di-n-butyl ester of piperonylidenemalonic acid appeared to be a better synergist than piperonyl cyclonene. It is stated that in preliminary tests, piperonyl butoxide was less effective than piperonyl cyclonene as a synergist but it showed more toxicity when used alone.

GAUL (A. T.). **Habits and Control of the Black Widow Spider.**—*J. econ. Ent.* **42** no. 4 pp. 700–701. Menasha, Wis., 1949.

Between September 1941 and December 1948, 137 black-widow spiders (*Latrodectus mactans*, F.) were collected by the author in New York City.

A table is given showing their distribution in the city, the approximate date of collection and the time spent in inspecting the area. The webs were typically found near the ground, on the underside of a fairly large plank or similar cover, in dry flat barren areas, including city dumps, rubbish-filled vacant land, railway yards, demolition and construction sites, and one of the city parks. They were never observed over pavement. A few atypical places in which webs were found are described. The spiders were collected in all but two months of the year, but were most numerous in September. There were indications of considerable movement of the spiders in the warm months, particularly of young individuals in early autumn. Control was successfully effected by clearing all litter from an area and establishing grass or other vegetation.

Carter (R. H.) & Mann (H. D.). **The DDT Content of Milk from a Cow sprayed with DDT.**—*J. econ. Ent.* **42** no. 4 p. 708, 3 refs. Menasha, Wis., 1949.

In further work on the amount of DDT in the milk of sprayed cows [*cf. R.A.E.*, B **38** 53], the quantities found in the milk of an Iowa herd thoroughly sprayed with a wettable powder suspension containing 4 lb. DDT per 100 U.S. gals. on 17th July 1948 were 3, 1·8 and 0·9 parts per million on 19th, 22nd and 26th July and 1·4, 0·5 and 0·4 p.p.m. on 2nd, 9th and 24th August. Milking was done by hand with no particular precautions to prevent contamination with DDT from outside.

De Meillon (B.) & Golberg (L.). **Preliminary Studies on the nutritional Requirements of the Bedbug** (*Cimex lectularius* **L.**) **and the Tick** *Ornithodorus moubata* **Murray.**—*J. exp. Biol.* **24** no. 1–2 pp. 41–63, 1 fig., 34 refs. London, 1947.

The following is substantially the authors' summary. *Cimex lectularius*, L., can be reared to maturity from the first-instar nymph by feeding through a membrane on defibrinated, haemolysed blood of man and rabbit. The rate of development is not very different from that of bugs reared by feeding directly on these hosts, but the mortality is greater, and adults generally refuse to feed, or die shortly after feeding. In one instance, a few eggs were laid after feeding through a membrane. It was found that even small changes in the blood fed through the membrane led to the death of the bugs in the early stages of development. On the other hand, quite extensive changes brought about in blood *in vivo* by the injection of dicoumarol and heparin appeared to have little if any effect on the development of nymphs fed directly on the animal so treated. Serum or blood cells alone fed through a membrane were highly toxic for *C. lectularius*. Serum could not be replaced by papaic liver digest or normal saline, nor could red cells be replaced by 5 per cent. papaic liver digest or a nutrient medium.

The symbionts of the bug are apparently unaffected by feeding on a rabbit injected with penicillin. It was shown that the penicillin was inactivated in the intestine of the bug within an hour of feeding. No success attended efforts to kill the symbionts by injection of penicillin into the haemocoele of fifth-instar nymphs. Bugs fed on rats deficient in thiamin and folic acid developed at about the normal rate, but the mortality was slightly increased and reproduction markedly affected. In the case of the thiamin-deficient rat, most eggs laid were sterile and of the " taub " variety. The normal rate of development on a thiamin-deficient rat suggests that the symbionts of the bug produce thiamin. They also probably produce folic acid.

Nymphs of *Ornithodoros moubata*, Murr., fed on a thiamin-deficient rat, were smaller than those fed on a normal one, and their rate of development was significantly slower. The bite of *O. moubata* produced a more pronounced haemorrhagic skin reaction in a thiamin-deficient rat than in a normal one. The economy of *O. moubata* and *C. lectularius* is adversely affected by feeding on deficient animals when the influence of activity of the host is definitely excluded.

Ramachandra Rao (T.). **Visual Responses of Mosquitoes artificially rendered Flightless.**—*J. exp. Biol.* **24** no. 1–2 pp. 64–78, 6 figs., 8 refs. London, 1947.

The following is based on the author's introduction and summary. The work of Kennedy [*R.A.E.*, B **28** 167] showed that flying mosquitos (*Aëdes aegypti*, L.) orientate themselves inaccurately but consistently away from the source of a horizontal beam of artificial light and that when presented with moving black stripes they tend to face one or other of them. This characteristic negative phototaxis of mosquitos during daytime has been observed by other workers. It is also known that mosquitos of many species tend to leave daytime shelters at dusk and move towards comparatively brightly illuminated exits. The studies reported in this paper were made to determine more exactly the mechanism of orientation to light and darkness and to observe experimentally if there was a change of direction of taxis at dusk. The mosquitos used were females of *Anopheles maculipennis atroparvus*, van Thiel, and of an autogenous form of *Culex pipiens*, L., for which the author uses the name *C. molestus*, Forsk. [*cf.* **35** 119]. They were rendered flightless either by sticking the wings together or removing them so that their movement towards light or darkness could be easily followed and their track recorded.

Most of the mosquitos tended to move towards a black vertical band when it was presented to them in an arena uniformly lighted from below. The narrowest width of band to which they could consistently respond was 0·5 cm. at a distance of 3·5 cm., corresponding to an angle of about 8°. When the edge of a wide black band was exactly in front of the mosquito or at about 45° to one side, the movement towards it was consistent, but when the band was placed more and more posteriorly, consistency of the responses progressively decreased. When two black bands of equal or different widths were offered simultaneously, the movement was to one of them. If a new band came into view when the mosquito was already moving towards another, a turning response towards the new one frequently took place. Unilaterally blinded mosquitos performed circus movements in uniform light. When a narrow black band came into the visual field of the functional eye, there was an immediate turning response towards it. The negative phototaxis continued even at and after dusk at a time when flying mosquitos were moving towards the evening light. Both reduction of intensity of illumination and the natural fading of the light at dusk failed to bring about a reversal of response. For some undetermined reason, mosquitos rendered flightless always tend to move away from light. The mechanism of orientation seems to be in conformity with current ideas of negative phototropotaxis. No evidence of photohorotaxis was obtained.

Lumsden (W. H. R.). **Observations on the Effect of Microclimate on Biting by** *Aëdes aegypti* (**L.**) (**Dipt., Culicid.**).—*J. exp. Biol.* **24** no. 3–4 pp. 361–373, 2 figs., 20 refs. London, 1947.

The following is virtually the author's summary. Work on the factors controlling the avidity of females of *Aëdes aegypti*, L., for a blood-meal [*R.A.E.*, B **30** 86] was continued. Mosquitos that had recently emerged were kept for 96–120 hours in darkness at about 25°C. [77°F.] and 80 per cent. relative humidity, and were then offered a blood-meal on the human arm in darkness. Wide variations in the light intensity during the few minutes' manipulation immediately previous to offering the host did not significantly affect the numbers feeding. The relative humidity of the environment at the time of biting appeared to be of little or no importance. The optimum environmental temperature for biting was near 35°C. [95°F.]. At this temperature, out of batches of ten mosquitos offered five minutes' opportunity to feed, means of $8{\cdot}8 \pm 0{\cdot}44$ and $9{\cdot}2 \pm 0{\cdot}33$ fed at high and low humidities, respectively.

Large proportions of females of *A. aegypti*, confined within 8·5 cm. of a host and in darkness, located the host and fed when environmental temperatures were close to or even above the skin temperature. Some factor other than the presence of a temperature gradient rising to the skin must therefore be responsible for their orientation to, and probing of, the host. In most fed mosquitos, blood was found in the stomach alone, but partly fed mosquitos showed a higher proportion with blood in the diverticula than did those fully engorged. This is probably due to regurgitation of blood from the stomach when feeding is interrupted.

Davies (L.). **Laboratory Studies on the Egg of the Blowfly** *Lucilia sericata* **(Mg.).**—*J. exp. Biol.* **25** no. 1 pp. 71–85, 3 figs., 20 refs. London, 1948.

An investigation was undertaken to determine the effects on the development and hatching of eggs of *Lucilia sericata*, Mg., of humidity fluctuations of a kind likely to occur under natural conditions in the fleece of a sheep [*cf. R.A.E.*, B **23** 227; **29** 61–62, etc.]. A study of the egg-shell was also made. The following is based on the author's summary of the results. The chorion of the egg of *L. sericata* is shown to be composed of two main layers, both of protein; the outer can be tanned by parabenzoquinone, but the inner is apparently already tanned. The chorion and the chorionic vitelline membrane are both lipidised shortly before the egg is laid. This makes both structures more rigid, but does not render the shell waterproof. After the lipidisation process is completed, a lipoid waterproofing layer is laid down by the öocyte, between the chorion and the chorionic vitelline membrane. This waterproofing layer has a critical temperature in the region of 38°C. [100·4°F.], above which water permeability increases abruptly, and can be damaged by an abrasive dust, emulsified by the detergent I.C.I. C09993 [a polyethylene glycol cetyl ether] and removed by chloroform at 30°C. [86°F.] in 12 hours.

The minimum relative humidity for development of eggs of *L. sericata* at 37°C. [98·6°F.] was found to be 50 per cent. At 38–39°C. [100·4–102·2°F.], eggs need about 80 per cent. relative humidity to complete development. Observations on temperatures within the fleece indicated that eggs laid very close to the skin of the sheep may have to develop at temperatures approaching the "critical temperature" of their waterproofing layer. Eggs at 37°C. can withstand fairly long periods of relative humidities below 50 per cent., provided that they have not been previously incubated in saturated air at that temperature. Exposure for seven hours from the time of laying to 30 or 40 per cent. relative humidity was necessary to cause approximately 50 per cent. mortality. Previous exposure to saturated air, even if for only 30 minutes, makes eggs far more susceptible to desiccation when subsequently incubated at a low humidity. If humidity is too low to permit rapid hatching, fully developed larvae can survive imprisonment within the egg-shell for about 3 hours at 37°C. At this temperature, a small proportion of eggs in each batch hatched at 50 per cent. relative humidity, presumably those that were protected against the effects of low humidity, but all larvae that hatched at 50–70 per cent. relative humidity and 37°C. were weak and shrivelled and died soon after.

DAVIES (L.). **Observations on the Development of** *Lucilia sericata* **(Mg.) Eggs in Sheep Fleeces.**—*J. exp. Biol.* **25** no. 1 pp. 86–102, 7 figs., 9 refs. London, 1948.

Laboratory studies by the author [*cf.* preceding abstract] showed that eggs of *Lucilia sericata*, Mg., can survive for fairly long periods under rather dry conditions at the temperature found near a sheep's skin and would thus be expected to complete their development in fleeces if a rapid increase in relative humidity occurred during the incubation period. Investigations were therefore made in northern England to determine whether such fluctuations in relative humidity occur during summer weather. The following is mainly based on the author's summary of the results.

Comparative determinations of the relative humidity of the atmosphere in the fleece using cobalt-chloride papers and paper hygrometers showed that the former were reliable for relative humidities between 40 and 70 per cent. Determinations made by means of wool samples were found to be subject to large positive errors, since the wool near the skin did not appear to be in equilibrium with the fleece atmosphere. Measurements of fleece relative humidity (relative humidity of fleece atmosphere within 1 cm. of the skin) by cobalt-chloride paper on 28 sheep of various breeds showed a considerable variation from day to day in individual sheep and in different sheep at the same time. The common condition was one of low relative humidity, unsuitable for the development of blowfly eggs.

Measurements of relative humidity and a study of the fate of freshly laid egg batches of *L. sericata* placed in the fleeces of sheep showed, however, that conditions suitable for development occurred comparatively frequently in the fleeces of some sheep. In such animals, the crucial factor would appear to be the extent and rapidity of rises in fleece relative humidity that would enable the eggs to hatch. Humidities high enough for hatching (60–80 per cent.) were comparatively rarely found. Sudden rain, or sunny showery weather, in addition to promoting fly activity, could probably cause sudden rises in fleece relative humidity that would make hatching possible. Under such conditions, the ability of the larvae to remain in the shell for three hours [*cf.* preceding abstract] is of potential importance, since, especially in hilly districts, heavy rain may occur within short periods during weather that is mainly sunny and suitable for fly activity. Blowflies are particularly active during the early morning, and eggs laid then would be reaching hatching condition during a period when dew was falling or when the sheep might be lying in dew-laden vegetation. The sudden rise in basal fleece relative humidity when the outside of the fleece is wet might lead to hatching. The inability of eggs to withstand desiccation after incubation in saturated air for a few minutes may be of importance in preventing strike development in the field, particularly when eggs are laid immediately after rain, since water on the outside of the fleece raises the relative humidity near the skin for a very short time.

Rapid sweating leading to suitable humidity conditions for strike sometimes occurred. The various sheep used showed great differences in sweating rates, the most rapid rate being found in two lambs in which, at one period, the limiting factor for strike must have been failure to attract flies. During rapid sweating, the relative humidity of the fleece was highest near the skin, a reversal of the gradient to be expected on the grounds of thermal stratification. The relative humidity 3 cm. from the skin tended to follow variations in macroclimatic relative humidity, but relative humidity at the skin surface did not.

Cragg (J. B.). **Studies on *Lucilia* Species (Diptera) under Danish Conditions.**—*Ann. appl. Biol.* **37** no. 1 pp. 66–79, 2 figs., 29 refs. London, 1950.

The following is mainly based on the author's summary. Whilst sheep myiasis caused by *Lucilia sericata*, Mg., is a severe economic problem in Great Britain, it rarely reaches such proportions in the continental countries on the western borders of Europe. Possible reasons for this were investigated in Denmark. Notes are given on the topography and weather of the chosen area (the Mols peninsula of Jutland) and on methods of sheep farming there. Trapping studies made during the experimental period (19th July to 15th August 1948) showed that blowflies normally associated with myiasis in Great Britain, and particularly *L. sericata*, occurred fairly abundantly in the area. The numbers of various species taken are shown in a table. The reactions of Danish individuals of *L. sericata* to attractive materials placed on sheep were similar to those shown by the species under British conditions. The number of egg batches laid on sheep in response to chemical stimuli was smaller than would have been expected in Great Britain. On the two occasions on which the eggs were left in position under moist pads, they hatched and the larvae established themselves. Studies on fleece microclimate showed that relative humidity on the skin surface was more often than not 50 per cent. or over. Humidities 3 cm. above the skin were markedly lower [*cf.* preceding abstract]. Thus, humidities suitable for egg development occurred fairly frequently at the skin surface [*cf. R.A.E.*, B **38** 122]. However, except during or immediately after rain, humidities high enough to ensure hatching were never recorded.

It is concluded that the virtual absence of myiasis from Denmark and its relatively low incidence in other countries is not due to the existence of a strain of *L. sericata* differing in oviposition habits from the British species. The changes that make sheep susceptible to attack are inadequately understood, but scouring, which in Great Britain often gives rise to myiasis, occurs in Danish sheep, so that it would appear possible for sheep to become attractive in some parts of Denmark. If susceptible sheep occurred and the blowflies oviposited on them, the development of myiasis would depend on the state of the fleece microclimate. Even in Great Britain, fleece humidity is an important limiting factor [**23** 227]. The incidence of myiasis appears to decline south-eastwards from the mountainous arc formed by the western areas of the British Isles and south-western Norway. The Danish results make it appear possible that the myiasis gradient largely reflects the importance of rainfall as a factor determining the development of myiasis.

Johnson (C. G.). **A Suction Trap for small airborne Insects which automatically segregates the Catch into successive hourly Samples.**—*Ann. appl. Biol.* **37** no. 1 pp. 80–91, 1 pl., 5 figs. London, 1950.

The following is the author's summary. This paper describes the design and operation of a suction trap which takes in air at a constant rate in winds up to 12 miles per hour. The catch is deposited in a collecting tube into which closely fitting disks fall, one every hour, thus segregating the catch into successive hourly samples. The trap is electrically driven ; it operates in all weathers and heavy rain does not disorganise the catch.

Bustamante (M. E.) & Varela (G.). **Distribución de las rickettsiasis en México (tifo murino, tifo clásico y fiebre manchada).** [The Distribution of Rickettsial Diseases in Mexico (Murine Typhus, classical Typhus and Spotted Fever.]—*Rev. Inst. Salub. Enferm. trop.* **8** no. 1 pp. 3–14, 3 figs., 5 maps, 15 refs. Mexico, D.F., 1947. (With a Summary in English.)

Knowledge of the distribution of rickettsial diseases of man in Mexico, hitherto dependent on the isolation of strains, was extended in 1947 with the adoption of the complement-fixation test. Epidemic typhus is now known to occur in 19 States and murine typhus in 18. Spotted fever of the western type [*cf.* *R.A.E.*, B **32** 78] occurs in the States of Sonora, Sinaloa, Coahuila and Durango, and infected examples of *Rhipicephalus sanguineus*, Latr., have been found in two places [**34** 100 ; **36** 54], while examples of *Amblyomma cayennense*, F., infected with the eastern type have been found in Vera Cruz [**36** 110]. An infection of low virulence was found in *R. sanguineus* from San Luis Potosí. The distribution of the three diseases is shown on maps and discussed ; all three are present in Coahuila.

MAZZOTTI (L.) & OSORIO (M. T.). **Observaciones sobre la biología del** *Ornithodoros furcosus* **Neumann.** [Observations on the Biology of *O. furcosus*.]—*Rev. Inst. Salub. Enferm. trop.* **8** no. 1 pp. 57–62, 2 refs. Mexico, D.F., 1947. (With a Summary in English.)

Ornithodoros furcosus, Neum., was described from Ecuador in 1908 but was not found again until many years later. In 1941, the senior author observed numerous examples in cracks in the walls and floors of adobe huts and also in pigsties in four localities in the mountains of that country. They apparently fed on man and domestic animals, but they may also feed on wild animals. In the laboratory they readily engorged on man, small laboratory animals, pigeon and *Macaca mulatta* (*Macacus rhesus*) and engorgement required only 15–20 minutes. Abundant coxal fluid was discharged at the end of a meal and also when the ticks were placed on a hot surface. Individuals were still surviving after five years in the laboratory. Little is known of the relation of *O. furcosus* to disease. No transmission of relapsing fever occurred when 100 field-collected examples were allowed to engorge on young mice, but the senior author showed that this species can harbour spirochaetes for long periods [*R.A.E.*, B **32** 109]. He and G. Varela subsequently observed that examples of *O. furcosus* harboured spotted-fever rickettsiae for at least 345 days and transmitted them to their immediate progeny, but no infection resulted from the bites of 13 of the latter. In breeding experiments, development from newly hatched larva to adult was completed in 9–11 months when meals were provided at fairly regular intervals and in 19–20 months when they were given only when the ticks appeared to have fallen off in size. There were 3–5 moults.

MAZZOTTI (L.). **Presencia en México de** *Triatoma protracta woodi*, **Usinger y de** *Triatoma gerstaeckeri* **(Stål).** [The Presence in Mexico of *T.p.woodi* and *T. gerstaeckeri*.]—*Rev. Inst. Salub. Enferm. trop.* **8** no. 1 pp. 69–70, 3 refs. Mexico, D.F., 1947.

During recent parasitological investigations in the north of the State of Coahuila, Mexico, *Triatoma protracta woodi*, Usinger, and *T. gerstaeckeri*, Stål, were found in the nests of wood rats (*Neotoma micropus canescens*) in an uninhabited region near Sabinas. The first had not previously been recorded from Mexico, but the second was collected in Nuevo León in 1941. Of 142 and 45 examples of these two bugs crushed and injected into animals, 8 and 5, respectively, were shown to be infected with *Trypanosoma cruzi*. Both have been found infected in the United States [*cf.* *R.A.E.*, B **28** 57 ; **30** 47]. No infection was demonstrated in 12 examples of the wood rat, but there is little doubt that it is a natural reservoir of the trypanosome [*cf.* **31** 184].

BUSTAMANTE (M. E.) & VARELA (G.). **IV. Estudios de fiebre manchada en México. Papel del *Rhipicephalus sanguineus* en la transmisión de la fiebre manchada en la República Mexicana.** [IV. Studies on Spotted Fever in Mexico. The Rôle of *R. sanguineus* in the Transmission of Spotted Fever in Mexico.]—*Rev. Inst. Salub. Enferm. trop.* **8** no. 2 pp. 139–141, 1 map, 4 refs. Mexico, D.F., 1947. (With a Summary in English.)

In this paper, which is one of a series [*cf.* *R.A.E.*, B **36** 110, etc.], it is reported that a strain of spotted fever was isolated from examples of *Rhipicephalus sanguineus*, Latr., taken at Montemorelos, Nuevo León, during recent investigations on this tick as a vector of the disease in Mexico. This is the fourth Mexican locality in which *R. sanguineus* has been found infected [*cf.* **38** 124], and these repeated records indicate that it is an important vector.

ROSSELL (C. S. C.). **Cultura cromogênica de um bacilo ácido-álcool resistente, isolado de mosquito (Culicíno) capturado sôbre leproso, em plena natureza, com rétrocultura obtida de rato branco.** [Chromogenic Culture of an Acid- and Alcohol-fast Bacillus isolated from a Mosquito (Culicine) taken on a Leper in the Open, with Back Culture from a White Rat.]—*Mem. Inst. Osw. Cruz* **44** (1946) fasc. 3 pp. 413–419, 5 pls. Rio de Janeiro, 1947.

In the course of work in a leper colony in Minas Gerais, Brazil [*cf.* *R.A.E.*, B **35** 122, etc.], the author caught mosquitos that had fed in the open on patients and used the stomach contents of each to obtain cultures and prepare slides in an attempt to demonstrate infection. The mosquitos were not identified, but were grouped as Anophelines and Culicines. Of the 65 slides prepared, 11 were positive for acid- and alcohol-fast bacilli, but only one culture (from a Culicine) developed. Material from this was injected subcutaneously into white rats and guineapigs, and one rat subsequently developed an abscess at the point of injection, pus from which showed acid- and alcohol-fast bacilli being phagocytised by white polynuclear corpuscles.

DE BARROS BARRETO (J.) & DE CASTRO (A.). **Aspectos epidemiológicos da peste no Brasil.** [Epidemiological Aspects of Plague in Brazil.]—*Mem. Inst. Osw. Cruz* **44** (1946) fasc. 3 pp. 505–527, 2 pls., 28 refs. Rio de Janeiro, 1947. (With a Summary in English.)

The authors discuss data on the incidence of plague in Brazil since 1934 and show that there has been a general decrease since the establishment of the anti-plague service in 1936 and its improvement in 1941. The disease is now limited to the north-east of the country [*cf.* *R.A.E.*, B **30** 34], with its major focus in the State of Pernambuco, and the mortality rate is not high.

Of the fleas collected from domestic rodents since 1943, 28·9 per cent. were from *Mus* (*Rattus*) *rattus frugivorus*, 26·5 per cent. from *M.* (*R.*) *r. alexandrinus*, 25·2 per cent. from *M.* (*R.*) *r. rattus*, 18·9 per cent. from *M.* (*R.*) *norvegicus* and 0·5 per cent. from *M. musculus*, but in spite of the low figure for the mouse, 62 examples were found infected with plague, as compared with 79 of *M. r. rattus*. *Xenopsylla cheopis*, Roths., comprised 88 per cent. of the fleas from it. Dead infected wild rodents of six species have been found.

The flea indices for the rodents in eight coastal towns ranging from Fortaleza, in the State of Ceará, in the north, to São Paulo, in the south, in 1941–45 varied with season and are shown to be highest in the rainy season. *X. cheopis* constituted 81·6 per cent. of the fleas identified in six of the towns in 1943–46, and *X. brasiliensis*, Baker, 14·6 per cent., and it is shown that the percentage of *X. cheopis* decreases and that of *X. brasiliensis* increases as the latitude increases, so that while the former is almost the only flea in Fortaleza and still outnumbers the latter in Santos, it becomes the less numerous of the two in São Paulo. The commonest rodent host of *X. brasiliensis* is *M. norvegicus*, and it is rare on *M. musculus*. There is no evidence that it is concerned in plague transmission in Brazil.

FERNÁNDEZ MELÉNDEZ (A.). **Aportación al estudio del** *Anopheles vestitipennis* **en Cuba.** [An Addition to the Study of *A. vestitipennis* in Cuba.]—*Tijeret. sobre Malar.* **10** no. 3 pp. 133–136, 8 refs. Maracay, 1946.

In the course of an Anopheline survey of the Province of Pinar del Río, Cuba, numerous adults of *Anopheles vestitipennis*, D. & K., were taken in traps in the coastal district of Guanímar, but larvae were not found in the local breeding places. According to the literature, which is briefly reviewed, this Anopheline has not so far been thought of much importance in the transmission of malaria, but natural infection has been reported from British Honduras [*R.A.E.*, B **30** 23]. The spleen index at Guanímar was high. A more detailed study of breeding places showed that a few larvae occurred in a swampy area near the shore, some 500 yards to the south of the nearest houses. This area bore a dense growth of high vegetation, in which the temperature was only 28°C. [82·4°F.], as compared with about 30°C. [86°F.] outside. The temperature of the water was 21–23°C. [69·8–73·4°F.], and its pH 7·3–7·6. The numbers of adults taken in houses diminished with increasing distance from this breeding place, and only a few occurred more than about 1,000 yards away.

In a study of feeding habits, traps baited with a man or a calf were operated on 20 evenings at positions about 300 yards away from the breeding place, and their relative situations were changed regularly. The mosquitos taken in the trap containing the man and (in brackets) in both traps comprised 770 (1,015) examples of *A. vestitipennis*, 332 (1,193) of *A. crucians*, Wied., 290 (645) of *A. albimanus*, Wied., and 1 (13) of *A. grabhami*, Theo. Females of *A. vestitipennis* taken in houses in the evening were dissected, but none was found infected, though one infected female of *A. crucians* was found. None of a number of females of *A. vestitipennis* that fed on a person showing gametocytes of *Plasmodium falciparum* and were dissected at death showed gland infection, but one had an oöcyst on the stomach.

GABALDON (A.) & COVA-GARCÍA (P.). **Zoogeografía de los anofelinos en Venezuela : III. Relaciones con el terreno y clima.** [Zoogeography of Anophelines in Venezuela. III. Relations to Terrain and Climate.]—*Tijeret. sobre Malar.* **10** no. 3 pp. 164–179, 3 refs. Maracay, 1946.

The following is based on the authors' summary of this third part of a series on the distribution of Anophelines in Venezuela [*cf. R.A.E.*, B **36** 54 ; **37** 227]. A study was made of the relations of 27 of the 29 Anophelines of Venezuela to type of territory, altitude, precipitation and temperature. Data concerning 11 of them were too scanty to be of much significance, but some conclusions were warranted. Of the five regions into which the country was divided, only two have species peculiar to them. These are the coastal region, with *Anopheles aquasalis*, Curry, and the Cordillera region, with *A. boliviensis*, Theo., and *A. vargasi*, Gabaldon, Cova-García & López. Of the 27 species considered, 23 and possibly 25 exist at altitudes below 330 ft. Only two are typical of the heights, *A. boliviensis* and *A. vargasi*. Of the others, 16 reach 1,640 ft., and six 3,280 ft. The latter are *A. argyritarsis*, R.-D., *A. boliviensis*, *A. eiseni*, Coq., *A. pseudopunctipennis*, Theo., *A. rangeli*, Gabaldon, Cova-García & López, and *A. vargasi*. *A. darlingi*, Root, reaches 2,975 ft., *A. albimanus*, Wied., 1,725 ft., and *A. argyritarsis* 5,880 ft. There are 15 species in districts with an annual precipitation below 19·7 ins. Of these, *A. albimanus*, *A. neomaculipalpus*, Curry, *A. oswaldoi*, Peryassú, *A. pseudopunctipennis* and *A. punctimacula*, D. & K., occur in a district with an annual mean precipitation of about 17 ins. There are 16 species in districts with an annual mean precipitation of 78 ins., of which *A. albimanus*, *A. apicimacula*, D. & K., *A. darlingi*, *A. neomaculipalpus*, *A. punctimacula* and *A. rangeli* occur in one place with an average of 106 ins. The average temperature for 12 species studied varied from 25·3 to 25·9°C. [77·54–78·62°F.], except for *A. argyritarsis* and *A. albimanus*, for which the averages were 24·7 and 26·1°C. [76·46 and 78·98°F.], respectively.

GALLIARD (H.). **Développement des microfilaires de** *Filaria malayi* **chez** *Aëdes* (*S.*) *aegypti* **et** *Aëdes* (*S.*) *albopictus*.—*C. R. Soc. Biol.* **141** no. 3–4 pp. 105–106, 1 ref. Paris, 1947.

Experiments carried out in Tonkin in 1938 [*R.A.E.*, B **27** 28] were resumed there in 1942. The development of *Filaria* (*Wuchereria*) *bancrofti* to the infective stage in *Aëdes aegypti*, L., was observed again, but only partial development was seen in *A. albopictus*, Skuse. Infection of the same two species of mosquitos with *F.* (*Microfilaria*) *malayi*, attempted without success in 1938 [*loc. cit.*], was obtained in 1942. The donor, who had no clinical symptoms, had 11 microfilariae per 10 cu. mm. peripheral blood at 11 p.m. when 22 females of *A. aegypti* and 40 of *A. albopictus* were allowed to engorge. Microfilariae were found in the thorax until the second day, and, on the ninth day, one developing and one infective larva were found in the head of a female of *A. aegypti* and two developing larvae and two infective ones (one in the thorax and one in the labium) in a female of *A. albopictus*. On the tenth day, one completely developed but degenerate larva was found in the labium of a female of *A. albopictus*. This is thought to be the first time that either of these mosquitos has been successfully infected with *F. malayi* and the first time that any human filaria has been reared to the infective stage in *A. albopictus*. Reference is made to unsuccessful attempts by other workers to obtain development of *F. malayi* in *A. albopictus* [**23** 289–290 ; **30** 85], and the reason for the discrepancy in results is discussed, without any definite conclusion being drawn.

PAPERS NOTICED BY TITLE ONLY.

STEINHAUS (E. A.). **Principles of Insect Pathology.**—$9\frac{1}{4} \times 6\frac{1}{4}$ ins., xi+757 pp., 219 figs., many refs. New York, N.Y. & London, McGraw-Hill Book Co., Inc., 1949. Price $8 or 68*s*. [See *R.A.E.*, A **38** 265.]

BEARD (R. L.). **Time of Evaluation and the Dosage-Response Curve** [in comparison of insecticides].—*J. econ. Ent.* **42** no. 4 pp. 579–585, 10 figs., 10 refs. Menasha, Wis., 1949. [See *R.A.E.*, A **38** 274.]

COLORADO I. (R.) & MENDIZÁBAL G. (D.). **Preparación del 2,2-(bis) p-fluorfenil 1,1,1-tricloroetano y demostración de la posición para del fluor en el compuesto.** [The Preparation of 2,2-bis(parafluorophenyl)-1,1,1-trichlorethane and Demonstration of the Para Position of the Fluorine in the Compound.]—*Rev. Inst. Salub. Enferm. trop.* **8** no. 1 pp. 63–68, 5 refs. Mexico, D.F., 1947. (With a Summary in English.)

MOSNA (E.). **Su una caratteristica biologica del *Culex pipiens autogenicus* di Latina.** [A biological Characteristic of *Culex pipiens autogenicus* from Latina.]—*Riv. Parassit.* **8** no. 2–3 pp. 125–126. Rome, 1947. (With Summaries in English and French.)

Culex pipiens autogenicus, Roub., was found breeding in water rich in organic content in war-damaged houses in Latina (Agro Pontino). When adults of this strain and one of Tuscan origin reared in the laboratory were placed in contact with the walls of a room that had been whitewashed and treated with a solution of 5 per cent. DDT in kerosene, the latter died in 3–5 hours, but the former survived for 32–48 hours. It is thought that *C. p. autogenicus* may comprise two races differing in their resistance to DDT.

SACCÀ (G.). **Sull'esistenza di mosche domestiche resistenti al DDT.** [The Existence of House-flies resistant to DDT.]—*Riv. Parassit.* **8** no. 2–3 pp. 127–128. Rome, 1947. (With Summaries in English and French.) Also in *R. C. Ist. Sanità* **10** pp. 923–924. Rome, 1947.

At the end of May 1947, during an inspection of buildings near Anzio that had been sprayed with a solution of 5 per cent. DDT in kerosene against mosquitos, it was observed that house-flies (*Musca domestica*, L.) were very numerous in sprayed rooms. The rooms were treated again under supervision, and a few days later the flies were just as numerous as before, if not more so [*cf. R.A.E.*, B **38** 87, 93]. When tested in the laboratory, these flies showed unusual resistance to DDT ; they were not killed by contact for 2–5 hours. It was then learnt that a similar failure to control *M. domestica* by means of DDT had occurred in Bonifica di Torre in Pietra (Province of Rome). Re-treatment there with DDT to give a deposit of 4 gm. per sq. metre gave a reduction of only about 5 per cent., whereas in other localities treated for the first time, 1 gm. per sq. metre from the same solution of DDT gave complete control. It is concluded that a resistant variety of *M. domestica* is involved, and since it occurs in the valley of the Tiber, the name *M. domestica* var. *tiberina* is suggested for it. Morphological differences are not indicated.

BETTINI (S.) & TENTORI (L.). **Insetti e vitamine. I. Revista sintetica. II. Vitamine A ed E nell'*Anopheles labranchiae* var. *atroparvus*.** [Insects and Vitamins. I. General Review. II. Vitamins A and E in *A. maculipennis* var. *atroparvus*.]—*Riv. Parassit.* **8** no. 2–3 pp. 129–139, 32 refs. Rome, 1947. (With Summaries in English and French.)

The authors review investigations in the literature on the importance of vitamins in the survival or development of insects and conclude that much reliance cannot be placed on the results of feeding experiments because it is usually impossible to know whether or not vitamins are supplied by the action of internal symbionts. They describe experiments in which extracts of the bodies of newly emerged adults and fourth-instar larvae of *Anopheles maculipennis* var. *atroparvus*, van Thiel (*labranchiae* var. *atroparvus*) that had been reared in the laboratory on a diet of wheat bran were tested for vitamins A and E and vitamin E, respectively. The results, which are given in tables, showed that vitamin A was not present in the lipoids of the adults of either sex. Vitamin E was present in both adults and larvae. Since vitamin E occurs in wheat bran, but not vitamin A, it is concluded that it accumulates in the fat-body of the mosquitos as a result of larval feeding.

MISSIROLI (A.). **Riduzione o eradicazione degli Anofeli?** [Reduction or Eradication of Anophelines?]—*Riv. Parassit.* **8** no. 2–3 pp. 141–169, 9 figs., 5 refs. Rome, 1947. (With Summaries in English and French.)

As a result of war operations and the formation of breeding places with brackish water, there was an outbreak of *Anopheles maculipennis* var. *labranchiae*, Flni. (*A. labranchiae labranchiae*) in the Agro Romano, near Rome, in 1944, with the result that malaria became epidemic. The author discusses the history of the control of Anophelines and malaria in Italy, and gives reasons for considering that with the advent of DDT, the discovery and properties of which are described, and other recent contact insecticides, it will be possible to eradicate the disease from Italy entirely within a period of five years by controlling adult Anophelines in buildings. He devised a plan for the eradication of malaria vectors and it received official sanction in time for work to begin in 1946. It involved the division of the country into four zones, the limits of which are shown on a map. They are broadly north-west and north-central Italy, where *A. maculipennis* var. *atroparvus*, van Thiel (*A. labranchiae* var. *atroparvus*) predominates and maintains a low degree of endemicity under certain conditions and it is thought that the use of DDT could be limited to the few districts in which transmission occurs; north-eastern Italy, including the coastal area of Venetia and Emilia where *A. m. sacharovi*, Favr (which the author treats as a distinct species) is the chief vector, and a wider belt of territory in which *A. m. messeae*, Flni. (which the author also treats as a species) effects transmission dependent on that by *sacharovi*, so that the latter alone need be controlled; central Italy, where *A. m. labranchiae* in Latium and Tuscany is at the northern limit of its distribution and transmits endemic malaria in the lowlands; and southern Italy, with Sardinia and Sicily, the main centre of dispersion of *A. m. labranchiae*, where widespread action is required.

Preliminary observations were made in Sardinia in 1946. Although *A. m. labranchiae* is the chief vector on the island, two others also occur, *A. m. sacharovi* and *A. superpictus*, Grassi. Both *labranchiae* and *sacharovi* must be controlled, since if *labranchiae* alone were eliminated, it would be replaced by *sacharovi*, which is at present not numerous. If both were eradicated, they would be replaced by some harmless form of *A. maculipennis*, Mg., probably *A. m. messeae*, with which *A. superpictus*, which is a mountain form and rare, could not compete. The attempt was begun in 1947, and it was hoped that it would prove successful in two years.

Work in central Italy was begun in 1946. Spraying with DDT was completed by mid-May, since transmission was believed to begin in the second half of that month, and it was thought that a single application would remain effective for a year or more, so that treatment in the following year need not be finished quite so early. Dwellings of all types were sprayed, and excellent results were obtained in all, control of mosquitos, *Phlebotomus*, fleas and bed-bugs [*Cimex lectularius*, L.] being complete. Inspection of breeding places showed the complete disappearance of larvae of *A. m. sacharovi* and great reductions in those of *A. m. labranchiae*, while *A. maculipennis* var. *typicus* and *A. claviger*, Mg., which are zoophilous and do not enter houses, were still present in numbers. In 1947, *A. m. labranchiae* was very rare. *Musca domestica*, L., was practically eliminated from treated areas in 1946, but reappeared in numbers in 1947, in spite of re-treatment, and it appeared that a resistant variety was involved [*cf.* *R.A.E.*, B **38** 129]; resistance was maintained in the offspring of flies taken to the laboratory for breeding, and is attributed to the constitution of the epicuticle. A resistant variety of *Culex pipiens autogenicus*, Roub., was also found in some districts [*cf.* **38** 129].

Blood examinations showed that transmission of malaria had been practically suppressed in treated areas in 1946, the few cases reported being on their borders. Detailed studies of mortality rates were made in three localities. The local mortality curve in 1945 had reached a peak in summer, but in 1946, after treatment, this peak did not occur. Since a summer peak still occurred in the curves for non-malarious districts, the change is not thought to be due entirely to malaria control, and it is suggested that the suppression of house-flies, which are known to transmit many pathogenic organisms, may have been responsible.

BEADLE (L. C.). **Note sullo sviluppo dell'*Anopheles sacharovi* sulla costa del Veneto.** [Notes on the Development of *Anopheles maculipennis* var. *sacharovi* on the Venetian Coast.]—*Riv. Parassit.* **8** no. 4 pp. 197–203, 10 refs. Rome, 1947. (With Summaries in English and French.)

The distribution of *Anopheles maculipennis* var. *sacharovi*, Favr (which the author regards as a distinct species) in the region of Venice is limited to a narrow coastal belt stretching from Ravenna to Trieste. It is commonly supposed that this is due to a preference for breeding in salt water [*cf.* *R.A.E.*, B **36** 61], but *sacharovi* has been found breeding in fresh water and transmitting malaria in the hinterland of Syria and is not limited to brackish water in Albania [*cf.* **28** 231 ; **30** 29]. The salinity of various inland breeding places in and near the Lagoon of Venice was therefore investigated in 1945. Larvae of *sacharovi* were found in water with contents of 0·0096–0·8 per cent. sodium chloride, and since water with a content of less than 0·1 per cent. is classed as fresh, it was evidently not restricted to brackish water [*cf.* also **33** 141]. It is suggested that the limiting factor might be the more severe winter conditions in the hinterland.

FLOCH (H.) & DE LAJUDIE (P.). **Sur la transmission de la lèpre par les arthropodes.**—*Publ. Inst. Pasteur Guyane* no. 138, 3 pp., 16 refs. Cayenne, 1946.

Literature on investigations on the possible transmission of leprosy by Arthropods is reviewed. In experiments in French Guiana, acid-fast bacilli were found in smears of the digestive tube of 4 out of 50 individuals of *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.) and 8 out of 235 of *Culex fatigans*, Wied., taken in a lepers' room. In 1944 and 1945, some colonies of acid-fast bacilli were obtained from four crushed examples of *Triatoma rubrofasciata*, Deg., that had engorged on lepromatous lesions and 96 of *C. fatigans* taken in a lepers' room. They could not be subcultured. Similar experiments with 15 individuals of *A. aegypti* taken at the Pasteur Institute and 10 of *Argas persicus*, Oken, taken in a hen-house were no more successful. On the other hand, a strain of acid-fast bacilli obtained in 1944 from ticks (*Boophilus annulatus microplus*, Can.) taken on cattle was successfully subcultured and compared with cultures of a strain received from Souza-Araujo, who isolated it from a leper in the course of his work in Brazil [*cf.* *R.A.E.*, B **35** 81, 122]. The strains differed in cultural characters, but not in the biochemical characters studied ; neither acidified sugars or produced tuberculin. It is considered that the tick strain was unquestionably, and the Brazilian strain possibly, composed of paratuberculous bacilli, most, though not all, strains of which do not produce tuberculin.

SMITH (C. N.), COLE (M. M.), JONES (E. A.) & CLARK (J. C.). **Investigations of Tick Repellents at Camp Bullis, Texas, 1948.**—*J. econ. Ent.* **42** no. 5 pp. 716–720, 4 refs. Menasha, Wis., 1949.

The following is substantially the authors' summary. Field tests with tick repellents were carried out at Camp Bullis, Texas, during April and May 1948. The repellents were applied at 2 gm. per sq. ft. to standard army fatigue uniforms, which were worn by a group of 25 men in areas heavily infested with *Amblyomma americanum*, L. The 19 materials tested were among those that had shown promise in previous laboratory and field tests. Most of them proved to have a high degree of repellency, with an average of more than 90 per cent. reduction in the numbers of ticks during the periods of tests, which varied from 3 to 6 weeks. Indalone, one of the more effective materials, is considered safe for use on both the skin and clothing. N-butylacetanilide, 2-[2-(2-ethylhexyloxy) ethoxy]ethanol, hendecenoic acid, hexyl mandelate and diethyl phthalate were highly effective and have been indicated as safe for use on clothing at the rate employed. The first three, however, were reported to be unsafe for use directly on the skin. Other highly effective compounds were Thanite, cyclohexanepropionic acid, 2-methylhendecanal, N-amyl-α-butoxyacetamide, dodecanal, isobornyl 4-morpholineacetate, and 1-[1-(3,3,5-trimethylcyclohexyloxy)-2-propoxy]-2-propanol. Thanite, N-butylacetanilide, cyclohexanepropionic acid, diphenylamine, 2-[2-(2-ethylhexyloxy)ethoxy]ethanol and 1-[1-(3,3,5-trimethylcyclohexyloxy)-2-propoxy]-2-propanol caused irritation to the skin of some subjects.

Impregnation of the uniforms with acetone solutions of the repellents gave slightly better results on the whole than impregnation with emulsions by a method of ionic exchange. Two of the compounds did not form satisfactory emulsions by this method.

The effectiveness of the treatments decreased somewhat with age, but the amount of wear to which the uniforms were subjected did not have a marked effect. Uniforms that were worn and tested 19 times over a period of six weeks after treatment with N-butyl-acetanilide, cyclohexanepropionic acid and 2-[2-(2-ethylhexyloxy)ethoxy]ethanol retained a high proportion of their original effectiveness at the end of the period.

CARPENTER (S. J.). **Collection of a Fourth Instar Larva of** *Anopheles albimanus* **at Boca Raton Field in 1944.**—*J. econ. Ent.* **42** no. 5 p. 834, 4 refs. Menasha, Wis., 1949.

The circumstances in which a fourth-instar larva of *Anopheles albimanus*, Wied., was found in May 1944 in a canal at an airfield in Florida are here described in rather more detail than in a paper already noticed [*R.A.E.*, B **34** 141].

SMITH (G. F.) & GEIB (A. F.). **Control of** *Aëdes* **Mosquitoes by direct Introduction of DDT into Irrigation Waters.**—*J. econ. Ent.* **42** no. 5 pp. 835–836, 1 ref. Menasha, Wis., 1949.

During 1946 and 1947, an attempt was made to control *Aëdes dorsalis*, Mg., and *A. nigromaculis*, Ludl., in flooded irrigation fields and pastures in south-central California, by introducing emulsion concentrate containing DDT into the irrigation waters before they entered the fields. Suitable equipment, consisting of a large drum with a siphon having a metering tip suspended directly in the irrigation stream, was developed during this period. In 1948, the method was further studied on two ranches. A concentrate containing 25 per cent. DDT, the formula of which is not known, was first used in 1946.

It proved very stable and of fine particle size and dispersed itself rapidly in water without agitation. When it was no longer available, various proprietary concentrates were tried, but all were unsatisfactory. An emulsion that is stable in the drum for the period required to empty it (about 24 hours) and has a dispersed stability of at least 36–48 hours is necessary to ensure uniform treatment over the whole period of application, when the siphons are refilled daily, and extremely small particles are also needed to allow of maximum contact with the larvae. New formulations were made up by several manufacturers specially for use in mosquito control, but only two were deemed suitable for the method under discussion. One of these was used in all the 1948 tests, the results of which are summarised. In both ranches, complete control of breeding was obtained by the method, using about 0·15 part DDT per million. The rapid reappearance of larvae after treatment was suspended indicated that such low dosages did not have any lasting action.

GRAHAM (O. H.). **An Attempt to protect Cattle from Grub Infestation by Use of Insecticides.**—*J. econ. Ent.* **42** no. 5 p. 837, 1 ref. Menasha, Wis., 1949.

An attempt was made in Texas in 1948 to protect cattle from infestation by *Hypoderma lineatum*, Vill., by spraying them every two weeks from 1st January to 28th April with high concentrations of chlorinated hydrocarbon insecticides with a view to killing the young larvae before they penetrate the skin. DDT, DDD (dichlordiphenyldichlorethane), methoxy-DDT (methoxychlor), chlordan, toxaphene and BHC (benzene hexachloride) were used as wettable powders at a concentration of 2 per cent. The BHC contained 12 per cent. γ isomer. DDT and BHC were also used in a combined spray at concentrations of 0·75 and 0·25 per cent., respectively. Application was made at a pressure of 300 lb. per sq. inch, and an average of 5 U.S. gals. was used per animal to wet the entire surface of the body. As three out of ten cows sprayed with chlordan died after the fourth application [*cf. R.A.E.*, B **37** 235], this treatment was discontinued. On 4th May, when one animal from each sprayed group was killed, first-instar larvae were found in the gullets of all except the cow that had been sprayed with BHC alone. Monthly counts of larvae in the backs of the cattle between 1st October 1948 and 14th January 1949 showed that there were as many in most of the sprayed groups as in the unsprayed controls. The BHC alone appeared to have reduced infestation considerably, but the concentration used was high, and there is little indication that BHC would be of practical value if used at safe concentrations only two or three times during the season.

PIQUETT (P. G.). **The Effect of four commonly used Synergists on a synthetic Pyrethroid.**—*J. econ. Ent.* **42** no. 5 pp. 841–842, 3 refs. Menasha, Wis., 1949.

A completely synthetic pyrethroid [the allyl homologue of cinerin I] known chemically as the *dl*-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of *dl-cis-trans*-chrysanthemum monocarboxylic acid [*cf. R.A.E.*, B **38** 103] has been prepared by M. S. Schechter, N. Green and F. B. LaForge. A dust containing 0·6 per cent. of it was compared in 1949 with one containing 0·6 per cent. pyrethrins, made from 20 per cent. pyrethrum extract, against males of *Periplaneta americana*, L., by a method already noticed [**37** 116, etc.]. The dusts were prepared by impregnating fuller's earth with a solution of the required quantity of the active ingredient in acetone, drying and passing through a 200-mesh sieve. The amounts of dust in the dishes were 25, 12·5 and 6·2 mg., and the mortality percentages in four days were 16, 3 and 7 for the synthetic material and 65, 13 and 17 for pyrethrins. When piperonyl butoxide, piperonyl cyclonene, N-propyl isome and sesame oil were incorporated in the 0·6 per cent. synthetic-pyrethroid dust at a concentration of 3 per cent. and the dosage per dish was 25 mg., the mortality percentages in four days were 80, 75, 87 and 22, respectively, as compared with 35 for the synthetic dust alone and 83 for 0·6 per cent. pyrethrins, although the adjuvants caused little or no mortality when used alone. It is therefore considered that there may be synergistic action between the synthetic pyrethroid and the first three of them. The addition of petroleum distillate to the synthetic dust at the same concentration as occurred in the dust prepared from pyrethrum extract did not affect its toxicity.

FURMAN (D. P.), DOUGLAS (J. R.) & MCKAY (K. G.). **Cattle Grub Distribution in California.**—*J. econ. Ent.* **42** no. 5 pp. 842–843. Menasha, Wis., 1949.

Hypoderma lineatum, Vill., has been recognised in California for many years [*cf. R.A.E.*, B **33** 173], but *H. bovis*, Deg., was not known to occur there until 1947, when it was reported from cattle not native to the State. A survey to determine its range and seasonal distribution was carried out over a period of two years, collections being made from native cattle in 44 counties. Both species were taken in 34 counties, *H. lineatum* alone in five and *H. bovis* alone in five. *H. bovis* occurred in all the counties near the Mexican border. This is thought to be the southernmost record for it in the United States. *H. lineatum* appeared in the backs of cattle earlier than *H. bovis*, by which it was replaced later in the season. This probably accounts for the finding of only one species in some counties, where the only collections were made either early or late in the season. For practical purposes, it may be said that both occur throughout the State. Since in districts in which both species are numerous the period of emergence of larvae on the backs of the cattle extends over six months, the previously recommended practice of treating three times at intervals of 30 days [*cf. loc. cit.*] will prove inadequate.

BARBER (G. W.) & SCHMITT (J. B.). **A Line of Houseflies resistant to Methoxychlor.**—*J. econ. Ent.* **42** no. 5 pp. 844–845, 2 refs. Menasha, Wis., 1949.

The lines of house-flies [*Musca domestica*, L.] used in the tests described are referred to as the Ellenville, NAIDM and Wilson lines, respectively. Flies of the Ellenville line had proved resistant to DDT [*R.A.E.*, B **38** 87–88]; the other two belonged to the susceptible laboratory strains used for comparison with them [*loc. cit.*]. In tests made in November 1948, the results of which are tabulated, exposures to deposits of DDT that gave complete kill of the Wilson line also killed all NAIDM flies, whereas exposure to deposits of methoxy-DDT (methoxychlor) resulted in decidedly less mortality in the NAIDM than in the Wilson line. Flies of the Ellenville line showed resistance to both DDT and methoxy-DDT. Flies of the NAIDM line showed no evidence of resistance to deposits of γ benzene hexachloride, parathion or chlordan.

HANSENS (E. J.) & GODDIN (A. H.). **Reaction of certain Fly Strains to DDT and Methoxychlor Deposits.**—*J. econ. Ent.* **42** no. 5 pp. 843–844, 1 ref. Menasha, Wis., 1949.

In view of the results of Barber & Schmitt [see preceding abstract], further tests were made of the resistance of different strains of house-flies [*Musca domestica*, L.] to deposits of DDT and methoxy-DDT (methoxychlor). As well as the Wilson and Ellenville strains and the NAIDM strain reared at Rutgers University [*loc. cit.*], flies of the NAIDM strain reared in the laboratories of du Pont de Nemours & Co. were used. The insecticides were applied to plywood as wettable powders or acetone solutions, and flies were caged on the wood for 15 minutes. When wettable powders were used, the deposits found necessary for complete mortality of the Wilson strain in one day were about 2·5 mg. per sq. ft. for DDT and 4·7 mg. for methoxy-DDT, while those for the du Pont and Rutgers NAIDM flies and Ellenville flies were 1, 1 and 15, and 1·5, 1·6 and 1·3 times as great, respectively. The deposits of methoxy-DDT needed to give 50 per cent. mortality were in the ratio 1 : 1·3 ; 1·6 : 1·9 for the four strains, respectively. The two NAIDM strains appeared to be equally susceptible to methoxy-DDT within the range of experimental variation. It is considered probable that the Wilson strain is slightly more susceptible and the Ellenville strain slightly more resistant to methoxy-DDT than the NAIDM strains. When deposits from acetone were used, 144 mg. DDT per sq. ft. gave complete kill of flies of the Rutgers and du Pont NAIDM strains and the Wilson strain, but only 25 per cent. mortality of Ellenville, while the same deposit of methoxy-DDT killed 53, 68, 86 and 38 per cent. of the four strains, respectively. This tends to confirm the results of the tests with wettable powders. Deposits of methoxy-DDT as high as 576 mg. per sq. ft. failed to kill all flies of any strain. It appears, therefore, that methoxy-DDT in acetone solution is more adversely affected by porous surfaces than is DDT.

Smith (C. L.) & Gates (D. E.). **County-wide Control of the Horn Fly with DDT.**—*J. econ. Ent.* **42** no. 5 pp. 847–848. Menasha, Wis., 1949.

During 1948, an experiment was carried out over an area of 720 sq. miles in Kansas to determine the feasibility of eradicating *Siphona irritans*, L., from large areas and to study the influence of community effort on such an attempt. The aim was to treat all the cattle in the area (Kiowa County) and such farm buildings as it seemed necessary to include for general fly control. Over 99 per cent. of the cattle owners co-operated in the treatment of animals, and it is estimated that 80–85 per cent. of buildings were treated. The cattle spray was made from 50 per cent. wettable powder diluted to contain 0·5 per cent. DDT [*R.A.E.*, B **38** 54] and was applied at a pressure of 450–500 lb. per sq. inch ; about 1 U.S. gal. was used per animal at the first application and slightly less at subsequent ones. The building spray was made from 25 per cent. emulsion concentrate diluted to contain 5 per cent. DDT and was applied at a pressure of 75–100 lb. per sq. inch. Cattle were first sprayed between 26th April and 25th May, and subsequently as soon as possible after fly populations were observed to have exceeded 25 per animal. The average number of flies per animal before the first treatment in 77 herds examined was 40·5. The number of treatments given to a herd varied from one to four.

The protection times in weeks afforded by the first and second sprayings were 9·33 and 4·75 in the outer area (0–2 miles from the border), 7·75 and 5·25 in the intermediate area (5–7 miles from the border) and 12 and 9 in the central area (10–12 miles from the border). Results obtained with third and fourth applications are not given because of incomplete records. The average weekly fly counts per animal from 31st May to 3rd September on untreated herds in the county were 55, 38, 35, 58, 152, 232, 249 and 355 for the first eight weeks, 535 for the tenth week and 1,044 for the thirteenth. No records were kept of the control of flies in general, but the results of the over-all spraying were excellent. Although the initial spraying of cattle did not eradicate *S. irritans*, it gave much longer protection than had been experienced before. In tests in 1947, the first treatment protected cattle for only about four weeks. The failure to effect eradication with one treatment may be attributable to lack of accurate information on the date of spring emergence and inadequate equipment for spraying the whole area before eggs were laid. The fact that the second application was less effective than the first was probably attributable to higher temperatures at the time of application, heavier rainfall, the retention of less DDT by the thinner summer coat and the delay of treatment while wheat was being harvested.

It is concluded that the eradication of *S. irritans* from large areas is difficult, and that effort by the whole county is essential for success.

Denning (D. G.). **Dusting for Sheep Tick Control.**—*J. econ. Ent.* **42** no. 5 pp. 852–853, 1 ref. Menasha, Wis., 1949.

Preliminary experiments on the control of *Melophagus ovinus*, L., on range sheep with dusts containing 0·5 per cent. rotenone applied immediately after shearing were carried out in Wyoming in the springs of 1948 and 1949. A crop row duster was used. It was placed at the end of a long, narrow dusting chute and had two nozzles at the top, four on the bottom and five on each side. It was operated by a six horse-power engine and delivered 2 lb. dust per minute. About 2,000 sheep could be treated per hour. Control obtained varied between 90 and 100 per cent. Whereas the number of keds on 20 untreated ewes selected at random was 9–311 (six ewes having more than 100 keds each), seven ewes examined seven days after dusting had 0–3 keds each, with a total of 6, and eleven examined 12–14 days after treatment had 0–12 keds, with a total of 21. No deleterious effects on the sheep were observed.

Schechter (M. S.), Pogorelskin (M. A.) & Haller (H. L.). **Colorimetric Determination of DDT in Milk and fatty Materials.**—*Industr. Engng Chem.* Anal. Edn. **19** pp. 51–53, 21 refs. Easton, Pa., 1947.

The analysis of milk for the presence of DDT is complicated by the large amounts of fatty matter that accompany the DDT when it is extracted in organic solvents, and in order to detect very small amounts of DDT, it is necessary to remove extraneous material and concentrate the DDT. In this paper, the authors describe a method by which concentrated sulphuric acid (in which fats are soluble, and DDT is not) was used to eliminate all but a small residue of fatty material. The analysis was completed by nitration and colorimetric analysis as already described [*R.A.E.*, B **35** 196]. The treatment may eliminate other interfering substances if they are soluble in sulphuric acid or easily sulphonatable. The method may be adapted for the analysis of biological tissues after they have been treated with sodium sulphate and extracted, the residue after evaporation of the solvent being dissolved in chloroform and treated with sulphuric acid as described. Bis(parachlorphenyl)-acetic acid is removed by the sulphuric-acid treatment and does not interfere in the analysis for DDT ; if it is to be determined it should first be separated from the sample by means of its acidic properties.

The procedure was tested for the detection of technical DDT and its dehydrochlorinated derivative, 1,1-dichlor-2,2-bis(parachlorphenyl)ethylene, with 100 and 97–99 per cent. recovery, respectively. Since the derivative is not removed by the sulphuric-acid treatment, its presence to any appreciable extent in a sample may be detected by its effect on the absorption spectrum of the developed colour ; it gives a red colour in the test, whereas DDT gives a blue one. It is expected that o,p′DDT and its dehydrochlorinated derivative would also be unaffected by the sulphuric-acid treatment. In tests of milk containing known amounts of technical DDT, concentrations as low as 1 part per million gave an easily discernible characteristic blue colour ; milk with no added DDT gave only a yellow colour. Analysis of milk, butter, fat and lean meat samples from cows that had received DDT in their food all showed the characteristic colour.

WASICKY (R.), UNTI (O.) & DA SILVA RAMOS (A.). **Contrôle do DDT empregado na profilaxia das moléstias transmitidas por insetos.** [Tests for DDT used in the Control of Diseases transmitted by Insects.]—*An. Fac. Farm. Odont. Univ. S. Paulo* **5** pp. 71–96, 1 graph, 26 refs. São Paulo, 1947. (With a Summary in English.)

Since commercial preparations of technical DDT frequently contain relatively small amounts of p,p′DDT together with various proportions of impurities, their analysis has become of importance. The authors review published physical and chemical methods of analysing the content of p,p′DDT in the technical product, suggesting simplifications in some cases, and describe two new colour reactions for DDT. For commercial preparations in liquid or powder form, bioassay methods involving spraying or dusting are recommended. In either case, the volatile components are eliminated from a liquid. For spraying, the DDT is extracted from the remaining liquid or from a dry preparation by means of acetone, graduated dilutions of the extracts with a solvent are made, constant volumes of these are sprayed into flasks, and adults of *Musca domestica*, L., or *Culex fatigans*, Wied., are introduced. The times required for 50 per cent. knockdown are compared with that for a standard solution of p,p′DDT. For dusting, the powder or the residue from a liquid after removal of the volatile components is mixed with talc in graduated proportions, flasks are dusted with known quantities of each mixture, and the insects are introduced. Comparison is again with a standard mixture of p,p′DDT. Differences of at least 5 and 10 per cent. in the content of DDT can be detected by spraying and dusting, respectively. DDT residues on surfaces, whether in buildings or on plants, are tested by dissolving the DDT in a solvent and analysing colorimetrically or by the biological methods. Deposits can also be tested indirectly by adding an indicator substance, such as methyl umbelliferone, to the preparation to be applied, removing a sample of the deposit on filter paper or cotton-wool soaked in alcohol and applying a colour test for the indicator. If phenolphthalein is used as the indicator, the deposit has merely to be moistened with a solution of sodium carbonate to show a red colour.

DAMPF (A.). **Notas sobre flebotómidos americanos (Diptera, Psychod.).** [Notes on American *Phlebotomus*.]—*Rev. Ent.* **18** fasc. 3 pp. 296–316, 16 figs., 24 refs. Rio de Janeiro, 1947. (With a Summary in English.)

In the first part of this paper, the author redescribes the hypopygium of the holotype male of *Phlebotomus atroclavatus*, Knab, from Trinidad [*cf.* *R.A.E.*, B **1** 234], and concludes from a comparison of the original figures of both sexes of *P. guadeloupensis*, Floch & Abonnenc, from Guadeloupe [*cf.* **34** 64] and the original figure of the male and Galliard's figures of the female of *P. tejeraae*, Larrousse, from Venezuela [*cf.* **11** 30 ; **22** 128] that these two are synonyms of *P. atroclavatus*. In the second part, he redescribes the holotype female of *P. imperatrix*, Alexander (1944), from Peru, and compares its measurements with those given for *P. pescei*, Hertig, from the same country, or obtainable from Hertig's figures [*cf.* **32** 41]. Only a comparison of the spermathecae of these two will show whether the differences between them are specific. The wing venation of Psychodids is discussed.

FAIRCHILD (G. B.) & HERTIG (M.). **Notes on the *Phlebotomus* of Panama (Diptera, Psychodidae). I. The Subgenus *Brumptomyia* Franca and Parrot 1921.**—*Ann. ent. Soc. Amer.* **40** (1947) no. 4 pp. 610–616, 6 figs., 9 refs. Columbus, Ohio, 1948. **II. Descriptions of three new Species.**—*T.c.* pp. 617–623, 18 figs.

In the first of these papers, which initiates a series designed to report on some 10,000 examples of *Phlebotomus* (comprising about 30 species) collected in

Panama in 1943–47, the scope of the subgenus *Brumptomyia* (as redefined by Mangabeira & Galindo [*R.A.E.*, B **33** 113]) is briefly discussed, and collection data are given on the three species of the subgenus found in Panama, all of which were represented by males only. Two of the species are described as new. A key to the males of the 12 known species of *Brumptomyia* is included.

The three new species described in the second paper, all from both sexes, form an apparently closely related group set off from the large group of Neotropical species bearing a basal tuft on the coxite by their inflated lateral lobes and the extreme proximal position of the basal spine of the style.

KNIGHT (K. L.). **The *Aedes* (*Finlaya*) *chrysolineatus* Group of Mosquitoes (Diptera : Culicidae).**—*Ann. ent. Soc. Amer.* **40** (1947) no. 4 pp. 624–649, 14 figs., 34 refs. Columbus, Ohio, 1948.

Edwards' "Group D (*chrysolineata* group : *Hulecoeteomyia*)" of the subgenus *Finlaya* of *Aëdes*, defined in a work already noticed [*R.A.E.*, B **21** 1], is redefined on the basis of an examination of types in the British Museum and new material in the United States National Museum, and a summary is given of characters common to the component species other than those included in the group definition. This characterisation makes it necessary to exclude from the group five species placed in it by Edwards, and include two species and a variety that have been described since Edwards erected the group, in addition to one species described as new in this paper from adults of both sexes and larvae from the Philippine Islands. The group now contains twelve species, one of them represented by two varieties, and descriptions of these and notes on their distribution and habitats where known are given, together with keys to the adults studied and to the known larvae. They include *A. koreicus*, Edw., which Edwards regarded as a variety of *A. japonicus*, Theo., but which is accorded specific status. A description is also given of larvae from the Philippine Islands closely related to *A. saxicola*, Edw., to which no name is assigned, and reference is made to three adult specimens in Museums that may also represent unknown species of the group.

ROZEBOOM (L. E.). **The Identity of the *Phlebotomus* associated with Bartonellosis in Colombia.**—*Ann. ent. Soc. Amer.* **40** (1947) no. 4 pp. 705–714, 20 figs., 8 refs. Colombus, Ohio, 1948.

The sandflies (*Phlebotomus*) taken from an area in southern Colombia where an epidemic of the severe form of bartonellosis known as Oroya fever had occurred in recent years [*R.A.E.*, B **30** 49] included two that were described by Ristorcelli & Dao Van Ty, as *P. colombianus* and *P. monticolus incarum* [**31** 11]. In 1943, the author received from Colombia a small series of females that he provisionally identified as *P. verrucarum*, Tns., but in 1945, Hertig reported that he was unable to find any Peruvian *Phlebotomus* in Columbia, and doubt was thus cast on the identification. Study of a large series of *Phlebotomus* from the bartonellosis region of Colombia showed most of them to be *P. m. incarum* or *P. colombianus*, but it was soon clear that the females could not be separated by the characters given by the authors and that no differentiating characters could be found between the females from Colombia and *P. verrucarum* of Peru as described by Shannon [**17** 190] and Hertig [**27** 106].

A detailed comparison was accordingly made of both sexes of the Colombian sandflies and of *P. verrucarum* from Peru, and the results of the study are given. The principal difference between the females of *P. colombianus* and *P. m. incarum* according to the original descriptions is in the structure of the spermatheca. However, separation of the Colombian females into groups according to the published characters revealed the existence of a third large group that could not be assigned with certainty to either of the other two, and no supplementary characters were found to support the grouping. No real differences could be found between these Colombian females and *P. verrucarum*, and apparent differences in the spermathecae were shown to be due entirely to the degree of collapse. It is concluded that there is no clear way of separating the female of *P. verrucarum* from the Colombian specimens studied by the author or those described by Ristorcelli & Van Ty as *P. colombianus* and *P. m. incarum*. As, moreover, all the 42 Colombian males associated with the females studied were the same, *P. m. incarum* is considered a synonym of *P. colombianus*. The male of *P. colombianus*, which is described, can be separated from that of *P. verrucarum* on the basis of a difference in the shape of the apical portion of the median clasper, but whether the Colombian form should have specific or subspecific status cannot be determined by morphological comparisons. It appears to be similar to *P. verrucarum* in its habits, especially in its readiness to attack man, and as it predominated in collections of sandflies from the bartonellosis area and many engorged individuals were taken in houses, it is thought to be responsible for the transmission of Oroya fever in Colombia.

HADAWAY (A. B.). **Observations on Mosquito Behaviour in Native Huts.**—*Bull. ent. Res.* **41** pt. 1 pp. 63–78, 1 pl., 2 refs. London, 1950.

Engorged mosquitos have been observed to leave DDT-treated native huts in Uganda, and may possibly do so without having acquired a lethal dose. As sub-lethal doses of DDT excite mosquitos so that they move to light [*R.A.E.*, B **35** 108] and as only a small percentage of DDT applied to mud-block surfaces is available in the outer layer [**38** 22], observations were made in specially constructed huts to determine the effect of treatment with toxic deposits on the entry and departure of mosquitos. The huts, which had a mud wall and grass roof, are described. They were situated 100 yards from a breeding place of *Anopheles gambiae*, Giles, and this was the only Anopheline taken in any abundance. Deposits of insecticide were very variable.

The following is mainly based on the author's summary. It was found that mosquitos continue to enter occupied, untreated native huts throughout the night, with peak periods of entry at dusk and dawn. Early morning catches do not give a true representation of the numbers entering and leaving huts during the night. Males of *A. gambiae* entered the huts at dawn. In a series of catches, 63 per cent. of 5,576 mosquitos of various species and 79 per cent. of 506 examples of *A. gambiae* were found resting on the underside of the thatch roof. By using five traps inserted in apertures one foot below the top of the wall, the numbers of mosquitos attempting to leave a hut were determined. Of 1,014 females that had entered before 10 p.m., over 60 per cent. remained inside until 6.30 a.m., and 71 per cent. of 143 females of *A. gambiae* remained for the same period. Catches to estimate numbers entering and leaving at different times during the night were also made, and the data are given in tables. Of the mosquitos taken in this part of the work, 72 per cent. remained in the hut for at least two hours.

Treatment of huts by spraying with DDT as a wettable-powder suspension or solution in kerosene did not interfere with the normal entry of mosquitos, and biting occurred in treated huts. The wettable powder appeared to be more effective than the solution. Some mosquitos entered the treated huts, fed and then left before acquiring a lethal dose. After making contact with treated surfaces, mosquitos became restless, but, under the conditions of the experiments, activation did not result in more leaving the treated huts than the untreated one. Unfortunately there were few examples of *A. gambiae*, and the predominant species entering was *Mansonia* (*Taeniorhynchus*) *fuscopennata*, Theo. Among females of *A. gambiae* released in unoccupied treated huts, some escaped into the traps before acquiring a lethal dose. Although there was a tendency for more to enter the traps of a treated than those of an untreated hut, the data were insufficient to show a significant difference. Most of the mosquitos entering the traps did so within one hour of their release. No examples of *A. gambiae* were still alive 12 hours after their release in huts treated 17 weeks previously with DDT wettable powder or DDT in kerosene, or in a hut sprayed 12 weeks previously with benzene hexachloride as a wettable-powder suspension. Only occasional individuals escaped to the traps in the latter hut.

NASH (T. A. M.) & DAVEY (J. T.). **The resting Habits of** *Glossina medicorum*, *G. fusca* **and** *G. longipalpis*.—*Bull. ent. Res.* **41** pt. 1 pp. 153–157, 2 pls., 2 refs. London, 1950.

Glossina palpalis, R.-D., *G. longipalpis*, Wied., and *G. fusca*, Wlk., have long been known to occur in the Olokemeji Forest Reserve, Nigeria, and one individual of *G. medicorum*, Aust., was taken there in February 1948 and two more some time later. Catches of the last three species made in the Reserve over a period of four days in late October 1949 (when the rains were ending) are described to illustrate the importance of searching for resting individuals when making a fly survey. The presence of *G. medicorum* and *G. fusca*, and possibly *G. longipalpis* also, might have been overlooked, had not resting flies been sought. The Reserve is about 25 sq. miles in area, and the vegetation consists mainly of high, mixed deciduous forest, underplanted in places with introduced species or replaced by plantations of teak.

G. medicorum proved to be abundant, but only one female attacked a collector, and none was attracted to screens or a bait pig. Flies of this species rested head downwards 1½–8 ft. from the ground on the shaded side of sapling trunks, chiefly of *Albizzia* sp. and *Bauhinia* sp., with a diameter of less than 3 ins. and generally of only about one inch. As they reacted very tardily to disturbance, they were best caught by making the upward sweep of the net much more slowly than is done for other species. *G. fusca* rested on teak trunks, also head downwards, the four individuals found being 5–9 ft. above ground level. This species was not found in the same places as *G. medicorum*, which was taken in an area within 100 yards of a river. Catching of *G. longipalpis* depended largely on hearing the sound of the flight of the approaching flies. They were taken on leaves, twigs and sapling trunks, often in the sun. Of 25 adults caught during the four days, only one was a female and only two attacked or even settled on man. It would appear that where game is abundant, *G. longipalpis* is very little attracted to man.

JACKSON (C. H. N.). **Wet Season Fraying of Wings of Tsetse-flies,** *Glossina morsitans*.—*Bull. ent. Res.* **41** pt. 1 pp. 159–160, 2 refs. London, 1950.

Comparative tables are given showing the amount of wing fray occurring in males of *Glossina morsitans*, Westw., of various ages, studied in Tanganyika in the dry and wet seasons (July 1945 and January 1949), respectively. There was no indication of any difference in the rate of fray in the two seasons [*cf. R.A.E.*, B **37** 59]. The brittleness of the trailing margin appeared to be directly related to age, so that the probability of any particular section of the margin wearing away in any particular time-interval increases directly with the passage of time. The law of diminishing returns did not appear to apply, perhaps because of the weakening of portions of the trailing edge between indentations fairly near together.

HADDOW (A. J.), GILLETT (J. D.), MAHAFFY (A. F.) & HIGHTON (R. B.). **Observations on the Biting-habits of some Tabanidae in Uganda, with special Reference to arboreal and nocturnal Activity.**—*Bull. ent. Res.* **41** pt. 1 pp. 209–221, 3 figs., 1 fldg. table, 11 refs. London, 1950.

The following is virtually the authors' summary. In a search for the forest vector of yellow fever [*R.A.E.*, B **37** 208, etc.], catches of biting Diptera were made by various methods in forest trees in Bwamba County, Uganda. The work here reported concerns Tabanids taken in catches made during the period 1944–45. Three species were taken in trees during these catches, and one of them, *Chrysops centurionis*, Aust., proved to be mainly arboreal. Observations on *C. centurionis* showed that its main biting activity begins just before sunset and reaches a peak during the hour after sunset. Thereafter, the numbers taken diminish rapidly, but some activity continues throughout the night. In the wet-season catches, this species was most prevalent in the forest canopy at heights of 50–60 ft. above ground. In the dry season, the most favourable level was lower, at 20–30 ft. above ground. It is suggested that monkeys are the natural hosts of *C. centurionis*, and that *C. centurionis* may be the vector of filarial infections among wild monkeys. It is shown that there is a very close correspondence between the biting behaviour of *C. centurionis* and that of *Aëdes africanus*, Theo. [*cf.* **35** 68]. Evidence of nocturnal activity has also been obtained in Uganda in the case of another species of *Chrysops*, one species of *Tabanus* and three of *Haematopota*. It is suggested that there may be some connection between the remarkable eye colours of Tabanids and crepuscular or nocturnal activity. Records of other Bwamba Tabanids are given.

VAN EMDEN (F. I.). **The Identity of the Species of *Hypoderma* (Dipt.) attacking Goat.**—*Bull. ent. Res.* **41** pt. 1 pp. 223–226, 3 figs., 6 refs. London, 1950.

The status of the species of *Hypoderma* that attack goats is discussed. It is shown that the Oriental species, *H. crossi*, Patt. [*R.A.E.*, B **10** 231] and the Mediterranean species described by Austen as *H. aeratum* [**19** 262] are distinct and distinguishable in both adult and larval stages, but that *H. aeratum* is a synonym of *H. aegagri*, Brauer, of which only larvae were known. These are the only species of which goats are the normal host.

KURTPINAR (H.). **Anadolu ehlî hayvanlarında görülen *Hypoderma* nevileri, iktisadî önemi ve mücadelesine dair en uygun tedbirler üzerine araştırmalar.** [Investigations on the Species of *Hypoderma* that attack domestic Animals in Anatolia, their economic Importance and the most suitable Methods of Control.]—*Çalışmalar Ankara yüksek Ziraat Enst.* no. 153, iv+60 pp., 21 figs., 75 refs. Ankara, 1947.

The species of *Hypoderma* observed by the author during several years' work in Anatolia were *H. bovis*, Deg., which was common on cattle, and a species considered to be *H. aegagri*, Brauer, on goats. All stages of the former and the adults of the latter are described, and diverse theories as to the way in which the larvae of *H. bovis* migrate through the body to the backs of the cattle are reviewed [*cf.* *R.A.E.*, B **31** 15]. In observations on cattle brought to a slaughterhouse in Ankara between January 1942 and July 1943, no larvae were found in the oesophagus. First-instar individuals occurred in the spinal medullary canal beneath the skin of the back in early January, and some beneath the skin had reached the second instar in that month. Third-instar larvae were found beneath the skin in February. All had left the animals by about the end of May, and adults were observed in the field in June.

Adults of *H. bovis* were reared in the laboratory by two methods. By the first, which proved the more practical, 5–10 full-fed larvae taken from living or slaughtered animals were transferred to a dish containing moist sand covered with a 2-cm. layer of dung and kept in bright sunlight [*cf.* **29** 48]. They entered the dung, and sometimes even the sand, but returned to the surface to pupate. Excessive moisture was detrimental to the pupae. By the other method, 25–30 full-fed larvae were placed on damp filter paper in an open dish. They pupated 12–24 hours later, and the pupae were transferred in lots of 2–3 to wide jars also containing filter paper ; further paper was placed over them to prevent the adults from flying. They were also reared in cages in the open, in which the pupal stage lasted about 25 days. Adults survived in the laboratory for up to 11 days. It is calculated from the whole work that larvae are present in cattle from early January to June, pupae occur from mid-February to the beginning of July, and adults from the beginning of May to mid-July.

Larvae of *H. aegagri* were not found in the oesophagus or spinal canal of slaughtered goats, but occurred beneath the skin of the back from October to late March. Pupae occurred from late February to early April, and the pupal stage lasted 18–25 days in the laboratory ; the adults survived for 3–5 days.

The economic importance of the infestation of domestic animals is discussed from the literature, and it is calculated that on the average, 67 per cent. of the cattle and goats in different parts of Anatolia are infested. Figures for the resulting losses of meat, milk and hides are given ; the annual value of the total loss exceeds 65 million Turkish pounds.

Laboratory and field experiments on the control of the larvae of *H. bovis* were carried out in 1942 and 1943. Derris extract proved fairly effective, but is considered too expensive for Turkish conditions, and a mixture of hydrogen peroxide and methylene blue, which is cheaper, is preferred. In the laboratory, a solution of 12 per cent. hydrogen peroxide with 1 per cent. methylene blue killed second-instar larvae wetted with it in 1–2 minutes, and third instars in 2–5 hours. In field tests on various lots of infested cattle, 97·5–99·1 per cent. of the animals were freed from infestation. The liquid is injected into the warbles by means of a syringe, and 2 cc. is sufficient for each. It kills the larvae and expels them from the warbles by the force of the froth and gases evolved.

KEISER (F.). **Der erste Fall von Ophthalmomyiasis, hervorgerufen von** *Oestrus ovis* **L., aus der Schweiz.** [The first Case in Switzerland of Ophthalmomyiasis due to *O. ovis*.]—*Verh. naturf. Ges. Basel* **59** pp. 29–44, 6 figs., 49 refs. Basle, 1948.

The author briefly reviews the literature on the bionomics of *Oestrus ovis*, L., and the kinds of myiasis caused by it ; when it infests man, the site of infestation is chiefly the eye [*cf. R.A.E.*, B **36** 119, etc.]. Previous records of such infestation are listed in a table and an account is given of a case in September 1947 in which 12 first-instar larvae were extracted from the eye of a workman in Basle. The first-instar larva is described.

JAMES (M. T.). **The Flies that cause Myiasis in Man.**—*Misc. Publ. U.S. Dep. Agric.* no. 631, 175 pp., 98 figs., 160 refs. Washington, D.C., 1947. Price 35 *cts.* (from Supt. Documents).

This paper comprises a summary of pertinent biological and pathogenic information on myiasis-producing flies of the world in so far as they affect man as host. Myiasis is classified according to the parts affected, and notes are given on the kinds of flies associated with each. The morphology of flies and their larvae is described, and information is given on the technique of rearing, preserving and shipping material. The bulk of the work relates to classification. Keys are given to the families of Diptera (adults and mature larvae) and to the myiasis-producing genera and species. Most of the keys are adapted from published works, but some are original. Descriptive and distributional notes and an account of biology and pathogenesis and a bibliography of the most important references are given for the chief species and some of this information for others.

STEINIGER (F.). **Eine weitere Beobachtung zur Frage des Läusestreuens.** [A further Observation on the Question of the Scattering of Lice.]—*Anz. Schädlingsk.* **21** pt. 2 pp. 27–28, 1 ref. Berlin, 1948.

Clothes lice [*Pediculus humanus humanus*, L.] are spread from person to person not only by direct contact but also by a process of scattering. The author has previously shown that this occurs when a person is so heavily infested that lice moving over outer garments come in contact with one another, so that their legs become entangled and lose their normally firm hold. The lice then fall to the ground in groups of 2–5, where they separate and are ready to attack fresh hosts. He has also observed that the lice lose their hold on clothing when they become torpid owing to cold. He instances a case in which heavily infested clothing was left in a heap in the yard of an institution at a time when the temperature was −6°C. [21·2°F.] and a moderately strong wind was blowing. The lice became torpid, and those on the outside of the heap were blown away to distances of some 10 yards, as far as the door of the building. Such lice would return to activity in a higher temperature and would then seek further hosts.

GÖTZ (B.). **Die Wirkung von Gesarol und anderen DDT-Präparaten auf Fische.** [The Action of Gesarol and other DDT Preparations on Fish.]—*Anz. Schädlingsk.* **21** pt. 3 pp. 39–40. Berlin, 1948.

In view of the claim that Gesarol (a preparation of DDT) was harmless to two species of fish on which it was tested, the effect of this and six other preparations of DDT on pairs of *Abramis lucidus* in glass containers was investigated. No injury was caused in 120 hours when 1 per cent. suspensions were added to the water at a rate to provide 5 parts DDT per million, but when the concentration of DDT was 10 p.p.m., some of the fish showed loss of balance in 24 hours and nearly all of them were affected in 72 hours. Some died in 96 hours, and only two still appeared normal. The survivors were then transferred to fresh water, but all died in three days. There was no mortality in the controls.

HOCKING (B.), TWINN (C. R.) & MCDUFFIE (W. C.). **A preliminary Evaluation of some Insecticides against immature Stages of Blackflies (Diptera : Simuliidae).**—*Sci. Agric.* **29** no. 2 pp. 69–80, 5 pls., 8 refs. Ottawa, 1949.

The following is based on the authors' summary. DDT, chlorinated camphene [toxaphene], chlordan, BHC [benzene hexachloride] and a preparation containing pyrethrum and piperonyl butoxide were tested in the field at Churchill, Manitoba, in 1947 for toxicity to the immature stages of *Simulium venustum*, Say, and some other Simuliids. Two experiments were made with aerial applications of DDT and 14 with direct applications of the various insecticides to streams. Descriptions of the streams and notes on methods used are given, and the results are shown in a table. Against larvae, DDT proved outstanding, adequate practical control being given by exposure for 15 minutes to a concentration of one part of DDT in ten million parts water, applied to the stream in the form of an emulsified or unemulsified oil solution or wettable powder. At the concentrations tested, DDT appeared to have no toxic effect on eggs or pupae. The application of DDT in oil solution by aeroplane at dosages of 0·26 lb. and 0·48 lb. DDT per acre early in the season controlled Simuliids in streams up to $1\frac{1}{2}$ ft. deep flowing through the sprayed area, and prevented reinfestation throughout the remainder of the season. BHC in emulsified solution gave about 50 per cent. control at 1 part γ isomer in ten million parts water for 15 minutes and a high reduction at twice that rate, but had no lasting effect. The other materials at the concentrations used were much less effective.

Data relating to the effect of DDT treatments on other invertebrates and fish are given and discussed. They indicate that far greater interference with the balance of nature may be expected from aerial than from ground applications. Suggestions for further investigations are made, and the design of equipment required for routine application of insecticidal liquids to streams is considered.

FLOCH (H.) & ABONNENC (E.). **Phlébotomes de la Guyane française. (XVII). *P. maripaensis* n. sp. et *P.* sp. de Maripa.**—*Publ. Inst. Pasteur Guyane* no. 140, 6 pp., 2 figs., 2 refs. Cayenne, 1946. **Distribution des phlébotomes en Guyane française.**—*Op. cit.* no. 142, 7 pp., 1 map. 1946.

In the first paper, which is one of a series [*R.A.E.*, B **34** 56], *Phlebotomus* (*Psychodopygus*) *maripaensis*, sp. n., is described from a single male taken on a river bank in forest in French Guiana. A description is also given of a female *Phlebotomus* that was taken at about the same time and that cannot be referred to any known species, but no name is proposed for it. The authors' key to the females of American *Phlebotomus* [*loc. cit.*] is amended to include this specimen.

In the second paper, the species of *Phlebotomus* taken in French Guiana since 1941, of which there were some 50 comprising more than 8,000 examples, are tabulated, to show the number of each species taken and the number of localities in which each was found. Notes are also given on the relative abundance, local and seasonal distribution and habitat of the various species. Only three species were observed to bite man, and of these only *P. anduzei*, Rozeboom, is common and widespread. Numerous cases of forest [mucocutaneous] leishmaniasis [*loc. cit.*] were observed in 1937 and 1938 among Annamese convicts in a locality where *P. anduzei* is common and feeds on man at nightfall.

BOYD (M. F.). Ed. **Malariology. A comprehensive Survey of all Aspects of this Group of Diseases from a global Standpoint.**—2 vols., $10\frac{1}{4} \times 7\frac{1}{4}$ ins., pp. xxi, 1–787, vi [+1], 788–1643, frontis., 437 figs., many refs. Philadelphia, Pa. and London, W. B. Saunders Co., 1949. Price £8 15*s*.

This comprehensive work of reference on malaria throughout the world, considered from all aspects, consists of 70 chapters by 65 contributors of many different nationalities.

The introductory section, which comprises a single chapter, is an historical review of knowledge of malarial infections, their etiology and transmission and the course of progress towards their eradication.

The section on parasitology comprises, in addition to a catalogue of the species of *Plasmodium* and index of their hosts, and a long series of untouched photographs of *Plasmodium vivax*, *P. falciparum*, *P. malariae* and *P. ovale*, a general discussion on the life-cycles of malaria parasites, a review of the species of *Plasmodium* attacking man (including *P. wilsoni*, the status of which is considered doubtful), briefer synopses of the malaria parasites found in other mammals and in birds, and descriptions of laboratory techniques used in the study of malaria infections, including infections in the mosquito, and of *in vitro* methods for study and cultivation of plasmodia.

In the section on the definitive host (the mosquito), which occupies some 350 pages, there are 15 chapters. These include a general introduction to the subject, accounts of the physiology of mosquitos, and of the morphology, bionomics and ecology of Anophelines, and reviews of the Anophelines of each of the zoogeographical regions, with keys and notes on classification, distribution and sometimes breeding places. There is also a long exposition on laboratory and field technique in the study of Anophelines, and techniques applicable to the study of simian malaria and the experimental infection of birds are discussed more briefly. Knowledge on the vectors of the malaria parasites of vertebrate hosts other than man is reviewed, with a list of mosquitos known to be susceptible, showing the species of *Plasmodium* with which they can become infected and the appropriate references to the literature.

The epidemiology, prevalence and distribution of malaria, its incidence in various parts of the world, the making of epidemiological and entomological surveys, and the transmission of malaria by Anophelines breeding in bromeliads are all discussed in the section on the intermediate (vertebrate) host, which also includes chapters on pathology, immunity and symptomatology, the treatment of malaria, prophylaxis by drugs, blackwater fever, and induced malaria as a therapeutic agent.

The final section, on control and eradication, occupies more than 300 pages. After a general introduction, the remaining chapters fall into two main groups, one consisting of surveys of malaria control in various regions and in the United States Army, and one consisting of discussions of the various methods of approach in Anopheline control. These are species sanitation and eradication, the use of repellents and other means of personal protection, the protection of dwellings, the trapping or deflection of adult Anophelines, the use of insecticides against adults and larvae, and various aspects of drainage and water management and other naturalistic measures. The final chapter is on planning malaria control on national and international scales.

There are two appendices, one consisting of a list of suggested equipment for field and laboratory investigations, with the name of the United States supplier in each case except for reagents, and the second of a provisional directory of United States manufacturers and distributors of equipment and supplies for anti-Anopheline operations. There is an index to the references in the text to the authors whose works are cited in the bibliographies that appear at the end of individual chapters, and a subject index occupying 138 pages.

ELMENDORF jr. (J. E.). **Preliminary Report on Field Experiments to demonstrate Effectiveness of various Methods of Malaria Control.**—*Amer. J. trop. Med.* **27** no. 2 pp. 135–145. Baltimore, Md., 1947.

A preliminary account is given of investigations made in 1945–46 in three of five comparable towns along a 15-mile stretch of the Atlantic coast of tropical America, where malaria is hyperendemic and *Anopheles albimanus*, Wied., is the vector, to compare the effectiveness of different antimalaria measures. Malaria surveys were made in April, August and December 1945 before treatment and in April or May 1946 after control measures had been in force for four months. The interiors of the houses in one town were sprayed or painted in December with 5 per cent. DDT in kerosene at 300–400 mg. DDT per sq. ft. Boxes exposed open on walls at the time of spraying were lethal to mosquitos (*A. albimanus* and *Aëdes aegypti*, L.) introduced into them and caused complete mortality among mosquitos so confined for five hours 129 days after treatment. An area forming a band one mile wide around another town was sprayed eight times from aircraft between 27th December 1945 and 2nd April 1946 with 5 per cent. DDT in diesel oil at 0·21 lb. per acre. The people of the third town received a weekly dosage of an antimalaria drug.

There was no evidence at the survey in April 1946 that the incidence of malaria had been reduced by the spraying from the air and very little that it was reduced by spraying houses. This was to be anticipated as the survey was made before the season of heavy transmission had begun. Any effect of these treatments would probably not be apparent until later surveys. The drug caused a marked drop in the incidence of the disease as measured by blood examination by comparison both with the previous year and with a control town.

Soper (F. L.), Knipe (F. W.), Casini (G.), Riehl (L. A.) & Rubino (A.). **Reduction of *Anopheles* Density effected by the pre-season Spraying of Building Interiors with DDT in Kerosene, at Castel Volturno, Italy, in 1944–1945 and in the Tiber Delta in 1945.**—*Amer. J. trop. Med.* **27** no. 2 pp. 177–200, 11 figs., 6 refs. Baltimore, Md., 1947.

The following is virtually the authors' summary. In 1944 and 1945, a spray of 5 per cent. DDT in kerosene was applied to the walls and ceilings of all buildings in specified areas of the Bonifica di Castel Volturno on the Italian coast just north of Naples. Results in 1944 were so promising that in 1945 a more extensive project was launched in an area of approximately 120 sq. miles in the Tiber Delta, where a 6·5 per cent. solution of DDT in kerosene was applied once at a rate of approximately 200 mg. DDT per sq. ft. to the interiors of all human habitations and animal shelters between 27th February and 15th June. The objective was to determine the lasting effect of the deposits upon Anopheline density in the absence of other control measures. The organisation of the field staff, the preparation of the insecticide and the equipment and methods used in its application are described.

Routine searches in Castel Volturno and in the Tiber Delta for adults and larvae of *Anopheles maculipennis labranchiae*, Flni. (*labranchiae labranchiae*, Flni.), the most important of the local vectors of malaria, indicated that density had been greatly reduced. A year after treatment, no Anophelines were found in previously sprayed buildings examined in the Delta. In Castel Volturno, a significant reduction in the parasite rate of school children occurred during the observation period of 16 months. While malaria morbidity in the Delta in 1945 was higher than in pre-war years, its distribution by months showed a rapid rise to a peak in March and a continuous drop thereafter, indicating that most, if not all, of the cases reported came from infections of the previous year. The usual summer rise in incidence failed to appear.

Eyles (D. E.) & Most (H.). **Infectivity of Pacific Island *Wuchereria bancrofti* to Mosquitoes of the United States.**—*Amer. J. trop. Med.* **27** no. 2 pp. 211–220, 5 refs. Baltimore, Md., 1947.

An account is given of studies undertaken to determine the susceptibility of mosquitos of the United States to a strain of *Filaria* (*Wuchereria*) *bancrofti* from Bora Bora in the Society Islands, believed to be representative of the "non-periodic" type found in several island groups of the South Pacific. East of 180° longitude, all filariasis is of the non-periodic type; between 140 and 180° east longitude, both non-periodic and nocturnal forms occur, and west of 140° east longitude, with certain exceptions, all filariasis is nocturnal.

The data obtained not only provide information on the potential vectors of *Filaria bancrofti* in the United States, but may also be of use with proper precaution in planning control work in the Pacific islands. Though many soldiers stationed in the Pacific war zone acquired filariasis, infections were mostly light, and few resulted in permanent clinical disease. The incidence of positive blood-smears among soldiers with filariasis was moreover less than 1 per thousand clinical cases, so that it would seem that the likelihood of American mosquitos acquiring the infection is slight.

Mosquitos of various species were allowed to feed on the donor, generally between 2 and 4.30 p.m., when the density of microfilariae was greatest (5·05 per cu. mm., with a standard deviation of 1·3). After the blood-meal, they were kept at 76–80°F. with a high relative humidity and given dilute sugar solution. They were dissected 10–20 days after feeding. *Culex restuans*, Theo., failed to feed, and a batch of about 50 females of *Aëdes sticticus*, Mg., died within 72 hours of feeding, probably because the filarial larvae had deleterious effects. The results of dissections of the species that fed are summarised in a table. No advanced larvae were found in *Anopheles quadrimaculatus*, Say, *A. maculipennis freeborni*, Aitken, *Psorophora ferox*, Humboldt, or *Aëdes* females belonging either to the species *A. atlanticus*, D. & K., or *A. tormentor*, D. & K. Development of the filariae to advanced or infective stages occurred in *Culex pipiens*, L., *C. fatigans*, Wied. (*quinquefasciatus*, auct.), *C. erraticus*, D. & K., *C. salinarius*, Coq., *Anopheles walkeri*, Theo., *A. punctipennis*, Say, *Aëdes triseriatus*, Say, *A. aegypti*, L., *A. atropalpus*, Coq., and *Mansonia perturbans*, Wlk. The potential importance of these species is discussed. From consideration of their habits and prevalence, it is concluded that only *C. pipiens*, of which 83·5 per cent. became infected with a mean of 9·2 advanced larvae, and possibly *C. fatigans*, of which 34·9 per cent. became infected with a mean of 2·7 advanced larvae, were sufficiently susceptible to be dangerous potential vectors. The results obtained with six species of mosquitos in this work are compared with those obtained by other workers with the same species and a nocturnal strain of *F. bancrofti* [*R.A.E.*, B **36** 115 ; *cf.* also **37** 231].

WELT (L. G.). **Use of Dimethylphthalate impregnated Clothing as Protection against Scrub Typhus.**—*Amer. J. trop. Med.* **27** no. 2 pp. 221–224, 1 map. Baltimore, Md., 1947.

The comparative frequency of tsutsugamushi disease (scrub typhus) was studied in three groups of infantry operating from August to November 1944 on an island of the South Pacific where *Trombicula deliensis*, Walch, one of the probable vectors of the disease [*cf. R.A.E.*, B **37** 91–92], was found on rats. One group (one battalion) wore clothing that had been sprayed with dimethyl phthalate, another (2½ battalions) wore clothing that had been impregnated with a 5 per cent. emulsion of dimethyl phthalate in a 2 per cent. soap solution, and the third group (one battalion) was not systematically protected in any way. Untreated shorts were worn under the impregnated uniforms, and there were no instances of dermatitis due to the dimethyl phthalate. Both treatments gave considerable protection against the disease, but impregnation was more effective than spraying. There were 45 cases among the men with untreated clothing, 16 among those with sprayed clothing and seven among those with impregnated clothing.

PRILL (E. A.), HARTZELL (A.) & ARTHUR (J. M.). **Some cyclic Acetals containing the 3,4-methylenedioxyphenyl Radical and their insecticidal Effectiveness against Houseflies.**—*Contr. Boyce Thompson Inst.* **14** no. 8 pp. 397–403, 11 refs. Menasha, Wis., 1947.

The following is virtually the authors' summary. A number of compounds containing the 3,4-methylenedioxyphenyl radical linked to a cyclic acetal ring have been prepared and tested, usually in admixture with a low concentration of pyrethrins, for insecticidal effectiveness against *Musca domestica*, L., by the Peet-Grady method. Of 14 cyclic acetals of piperonal studied (including two analogues in which oxygen of the cyclic acetal ring is replaced by sulphur or by nitrogen), the most active were found to be those formed from 2-methyl-2, 4-pentanediol, pinacol, glycerol α-*n*-butyl ether and 2,3-butanediol, by reaction with piperonal, and also a more complex cyclic acetal, 2-(3,4-methylenedioxyphenyl)-5-methyl-5-*n*-caproylamino-1,3-dioxane. The cyclic acetal of 6-bromopiperonal and 2-methyl-2,4-pentanediol was found less active than the cyclic acetal of piperonal and this glycol. The 5-methyl and the 2,5,6-trimethyl derivatives of 4-(3,4-methylenedioxyphenyl)-1,3-dioxane, made by the reactions of isosafrole with formaldehyde and with acetaldehyde, respectively, were also found quite active.

ROAN (C. C.) & KEARNS (C. W.). **Testing Insecticide Sprays.**—*Soap & sanit. Chem.* **24** no. 5 pp. 133, 135, 137, 149, 151, 4 figs., 3 refs. New York, N.Y., 1948.

Details are given of the construction and operation of an apparatus designed for testing contact sprays against *Musca domestica*, L. It consists of a small wind tunnel modified to accommodate a cage of test insects, which forms a section of it. The spray is drawn through the tunnel at a controlled velocity by means of an electrically driven suction fan. The droplet size is determined by the design of the atomiser and the air pressure used to operate it. The arrangement of the components and the important dimensions of the apparatus are shown in a figure. The air stream first passes through a mixing chamber containing the atomiser, then through a reducing funnel, which causes turbulence, thus making the distribution of the spray droplets more uniform, then through the test cage, then through a Venturi tube connected to an inclined manometer so that the velocity of the stream can be measured, and finally through an exhaust pipe by which it leaves the building. The airflow can be adjusted by means of a damper.

PAPERS NOTICED BY TITLE ONLY.

CHAUVIN (R.). **Physiologie de l'insecte. Les grandes fonctions, le comportement, ecophysiologie.**—$9\frac{3}{4}\times6\frac{1}{4}$ ins., 619 pp., 83 figs., many refs. Paris, Inst. nat. Rech. agron., 1949. Price *Fr.* 2500. [See *R.A.E.*, A **38** 345.]

RAJINDAR PAL. **The Wetting of Insect Cuticle.**—*Bull. ent. Res.* **41** pt. 1 pp. 121–139, 1 pl., 7 figs., 29 refs. London, 1950. [See *R.A.E.*, A **38** 311.]

KRIJGSMAN (B. J.), DRESDEN (D.) & BERGER (N. E.). **The Action of Rotenone and Tetraethyl Pyrophosphate on the isolated Heart of the Cockroach.**—*Bull. ent. Res.* **41** pt. 1 pp. 141–151, 5 figs., 43 refs. London, 1950. [See *R.A.E.*, A **38** 312.]

METCALF (R. L.) & MARCH (R. B.). **Studies of the Mode of Action of Parathion and its Derivatives and their Toxicity to Insects.**—*J. econ. Ent.* **42** no. 5 pp. 721–728, 15 refs. Menasha, Wis., 1949. [See *R.A.E.*, A **38** 317.]

BERCK (B.) & SMALLMAN (B. N.). **Chemical Methods of measuring DDT** [a review from the literature].—*Sci. Agric.* **29** no. 2 pp. 53–59, 22 refs. Ottawa, 1949.

Conferência intercolonial sobre tripanossomíases, Lourenço Marques, 26 a 31 de Agosto de 1946. [Intercolonial Conference on Trypanosomiasis, Lourenço Marques, 26th–31st August 1946.] **Vol. I.**—387 pp., 4 pls., 17 maps, 3 figs., 3 graphs. **Vol. II.**—458 pp., 11 maps, 3 figs., 5 graphs. Lourenço Marques, 1947.

These two volumes contain the Proceedings, published in both Portuguese and English, of the Intercolonial Conference on Trypanosomiasis held at Lourenço Marques on 26th–31st August 1946. Delegates attended from Angola, Bechuanaland, the Central African Council, Portuguese East Africa (Mozambique), Nyasaland, Kenya and Uganda, Northern Rhodesia, Southern Rhodesia, Swaziland, Tanganyika and South Africa. In the first volume, reports illustrated by maps are presented on the distribution of tsetse flies (*Glossina*) and the measures adopted against them in each of the various territories, and on the distribution in the latter of sleeping sickness and trypanosomiasis of domestic animals and the incidence of mechanical transmission by other blood-sucking insects. Sleeping sickness is stated not to occur in the Union of South Africa or Swaziland. H. E. Hornby and W. H. Potts introduced a discussion on favourable and unfavourable factors affecting the spread of the insect vectors. Hornby emphasised the importance of mechanical transmission by flies other than *Glossina*, with examples from Portuguese East Africa, and showed that climate as expressed through climax vegetation is the dominant factor in the distribution of the various species of *Glossina* in Africa. Potts discussed the effect of grass-burning on the savannah species of *Glossina* (*G. morsitans*, Westw., *G. swynnertoni*, Aust., and *G. pallidipes*, Aust.) in Tanganyika. Late burning is unfavourable to them because, unlike early burning, carried out while the grass is still green, it leaves no refuges from which the flies later emerge, and also results in exposure of the flies to long grass for a longer period. Complete exclusion of burning is also unfavourable, for the latter reason. Jackson has suggested that tsetse flies cannot spend more than 15–20 minutes a day in active flight without exhausting their reserves, and if this is so, unnatural activity caused by reduction of food sources and clearing may have a limiting effect.

The second volume opens with reports of the measures adopted in the various territories for the control of trypanosomiasis in man and animals, in which the chief emphasis is laid on medical and prophylactic measures, though the control of *Glossina* is included in some. These are followed by discussions of the value of the regular exchange of information between the territories and the control of migrant labour, reports on the distribution of game reserves in the various territories, with some reference to the general problems of game preservation and trypanosomiasis, and the recommendations approved by the Conference. These include recommendations for collaboration between territories on all matters concerned with the control of *Glossina*, investigation of the importance of mechanical transmission of trypanosomiasis to man and livestock and the effect of fire used to control *Glossina* on vegetative types, the exchange of information and the bodies to be responsible for it, and an improved technique of mapping the distribution of *Glossina* spp. and trypanosomiasis, symbols for which are shown in an appendix.

Miscellaneous communications are printed as addenda. In addition to two presenting additional information on the distribution of *Glossina* in Angola, those of entomological interest are "Report on a survey to ascertain if there be a danger that the *Glossina morsitans* belt associated with the rio Save [Sabi] may spread south-west to the rio Limpopo and beyond", by H. E. Hornby, in which the possibility of such a spread in Portuguese East Africa is considered unlikely, unless it is facilitated by the continued increase in buffalo and elephant in the intervening areas, and "Tests carried out for the purpose of determining the toxical power of the DDT in regard to *G. brevipalpis*", by A. T. F. Colaço, who gives the results of experiments in which examples of *G. brevipalpis*, Newst., were introduced into cages bearing deposits of DDT from kerosene solutions. Of 13 males exposed to a heavy deposit on cardboard with which a cage was lined, all were lying on the bottom of the cage after 15 minutes, one was dead after 180 minutes, and all were dead after 235 minutes. Three individuals removed from the cage after 15 minutes died within the same period as those left in it. When measured doses decreasing from 29 mmg. DDT per sq. cm. were applied in glass cages, the time required for mortality did not increase until 7 mmg. was reached.

BARONI (O.). **O tratamento do carrapato do gado bovino com DDT.** [The Treatment of Cattle with DDT against the Tick.]—*Biológico* **13** no. 9 pp. 157–161. São Paulo, 1947.

Ticks are common on cattle in Brazil, and the author discusses the advantages of DDT for their control. Spraying by means of knapsack or high-pressure apparatus is the best method of application, and excellent results have been obtained experimentally in Brazil with a 1 per cent. suspension of DDT in a proprietary wettable powder.

ROTH (A. R.) & LINDQUIST (A. W.). **Comparative Effectiveness of DDT, Methoxychlor, and Dichlorodiphenyl Dichloroethane Residues against House Flies and *Aëdes* Floodwater Mosquitoes.**—*J. econ. Ent.* **42** no. 6 pp. 871–873, 1 fig., 1 ref. Menasha, Wis., 1949.

Tests are described in which house-flies (*Musca domestica*, L.) and females of *Aëdes* were exposed for different periods in jars, the interiors of which had been coated with DDT, methoxy-DDT (methoxychlor) or DDD (dichlordiphenyl-dichlorethane) from acetone solutions not more than three days earlier. About 90 per cent. of the mosquitos were *A. sticticus*, Mg., and 10 per cent. *A. vexans*, Mg. Knockdown was recorded after 15–240 minutes and mortality after 20 hours. With exposure for one minute to deposits of 20 mg. per sq. ft., the percentages of flies knocked down by DDT and DDD were low after 15 minutes but increased rapidly during the next 3¾ hours to 90 and 86, respectively. The percentages killed were 99 and 86. Methoxy-DDT did not cause appreciably higher initial knockdown than DDT or DDD with exposure for one minute, and many flies revived within four hours regardless of exposure time. Mortality after 20 hours (31–94 per cent. for exposures of 1–15 minutes) was always less than knock-down after 15 or 30 minutes. In another series of tests, violent tremors often followed exposure to methoxy-DDT, which nevertheless was not fatal, whereas flies exposed on DDT died after having only mild tremors. Exposure for 20 minutes to a deposit of 1 mg. DDT per sq. ft. was less effective than exposure for one minute to 20 mg. With methoxy-DDT, a one-minute exposure to 80 mg. was less effective than a ten-minute exposure to 20 mg. When flies were exposed to deposits of 20, 40 and 80 mg. methoxy-DDT per sq. ft. in comparison with 2, 4 and 8 mg. DDT, respectively, the methoxy-DDT was not nearly so effective as DDT with exposure for one minute, and the same trend was noticeable with five minutes' exposure, but with exposure for ten minutes mortalities were almost identical. The fourfold increases in dosage did not considerably increase mortality.

The percentages of mosquitos killed by exposure for one minute to deposits of 1 mg. DDT, 20 mg. DDD and 20 mg. methoxy-DDT, and for 15 minutes to the methoxy-DDT were 83, 21, 21 and 86, respectively. In contrast to the results with the flies, knockdown by methoxy-DDT increased gradually from 15 to 240 minutes after exposure, and mortality after 20 hours was always greater than knockdown after 15 minutes.

YEAGER (J. F.) & MUNSON (S. C.). **Relationship between Knockdown and Survival Time for DDT-poisoned Flies and Roaches.**—*J. econ. Ent.* **42** no. 6 pp. 874–877, 1 graph, 7 refs. Menasha, Wis., 1949.

The following is based on the conclusions drawn by the authors from experiments in which DDT in maize oil was injected into large nymphs of *Periplaneta americana*, L., and others in which adults of *Musca domestica*, L., received an application of the same solution on the dorsal surface of the thorax from a calibrated wire loop. When the survival times of the flies are plotted against concentration, the curves obtained are hyperbolic, show no inflection of the kind previously reported for *P. americana* into which sodium metarsenite dissolved in saline solution has been injected [*R.A.E.*, B **33** 25 ; *cf.* also **35** 50 ; **38** 11–12], and can be described by the equation $(c\text{-}c_o)\ (t\text{-}a)=K$, where a, c_o and K are constants and c_o is negligibly small. When concentration is plotted against knockdown, the curves are similar in form, show no inflections and can be described by the same equation when a and c_o are both made negligibly small.

The difference between time for knockdown and time for death is approximately constant in the range of lethal concentration, when allowance is made for random experimental errors, whereas the toxic action of the DDT leading to knockdown is a function of the applied concentration. This suggests that the lethal action of the DDT, once the knockdown stage of poisoning has been reached, may proceed independently of the concentration administered. Less precise data for the cockroaches suggest that the same conclusions may apply, but in this case the experimental error was great.

CROSS (H. F.) & FYE (R.). **The Use of Sleeves for evaluating Acaricides as Clothing Treatments.**—*J. econ. Ent.* **42** no. 6 pp. 878–880, 3 refs. Menasha, Wis., 1949.

It has been found practicable to use impregnated jacket sleeves in testing acaricides as treatments for clothing to give protection against the Trombiculids as an intermediate process between laboratory tests of stopping time [*R.A.E.*, B **38** 30] and field ones on whole uniforms [**38** 29, etc.]. More tests per man can be carried out in this way than with whole uniforms, as well as paired tests on each individual ; and, as much less material is needed, new compounds of which only limited quantities are available can be tried. Results are given of tests made by the sleeve method with several compounds that had shown protective value in previous tests with impregnated uniforms. Results with the two methods were very similar, but sleeves generally withstood more washings than uniforms.

COLE (M. M.) & SMITH (C. N.). **Tick Repellent Investigations at Bull's Island, S. C., 1948.**—*J. econ. Ent.* **42** no. 6 pp. 880–883, 4 refs. Menasha, Wis., 1949.

The following is substantially the authors' summary. Field tests with 43 selected tick repellents (including the 19 that were also tested at Camp Bullis [*R.A.E.*, B **38** 132]) were carried out at Bull's Island, South Carolina, from late March to late July 1948. Regulation army fatigue uniforms of herringbone twill were impregnated with the repellents at about 2 gm. per sq. ft. from acetone solutions and worn in areas heavily infested with *Amblyomma americanum*, L. Initial tests were made weekly, and the 18 most promising substances were retested in daily wear. Six compounds that were irritating to the skin were discarded early in the first series of tests. The more effective compounds that caused no irritation in the tests and were also indicated to be safe for use on skin or clothing as a result of toxicological tests made on laboratory mammals by the U.S. Food and Drug Administration were Indalone, 2-phenoxyethyl isobutyrate, hexyl mandelate and ethyl β-phenylhydracrylate. Indalone was the most consistently effective. The outstanding compound on the basis of effectiveness alone was N-butylacetanilide, and it was followed closely by 2-[2-(2-ethylhexyloxy)ethoxy]ethanol and N-amyl-α-butoxyacetamide. They gave an average protection of over 90 per cent. for 7 or 8 days with daily wear. The first two were indicated to be safe for use on clothing at 2 gm. per sq. ft. but were very toxic when applied directly to the skin, and both caused irritation to the skin of some subjects in these tests. N-amyl-α-butoxyacetamide was indicated to be unsafe for use on clothing at 2 gm. per sq. ft. The dimethyl ester of *cis*-bicyclo[2.2.1]-5-heptene-2,3-dicarboxylic acid (dimethyl carbate) and 2-butyl-2-ethyl-1,3-propanediol were somewhat less consistently effective than the foregoing, but were indicated to be safe for use, the latter on clothing and the former also by direct application to the skin. Dimethyl carbate caused irritation to the skin in one instance.

In further tests in which acetone solutions and emulsions of three of the most promising repellents were compared, solutions of Indalone produced more effective impregnation than emulsions, but the two types of preparation were about equally effective in the case of 2-[2-(2-ethylhexyloxy)ethoxy]ethanol and dimethyl carbate. Treatment of uniforms with powders of Indalone and 2-[2-(2-ethylhexyloxy)ethoxy]ethanol (0·1 gm. per sq. ft.) gave fair to good protection for a single wearing.

DOUGLAS (J. R.) & FURMAN (D. P.). **Comparative Evaluation of Rotenone Formulations for Cattle Grub Control.**—*J. econ. Ent.* **42** no. 6 pp. 884–887, 7 refs. Menasha, Wis., 1949.

Experiments in continuation of those already noticed [*R.A.E.*, B **38** 2] were carried out in California to determine the effect of a wetting agent on the usefulness of a rotenone formulation, with or without sulphur, against *Hypoderma lineatum*, Vill., and *H. bovis*, Deg., the effect of the particle size of the sulphur, the part played by the sulphur and the relationship between rotenone content and effectiveness. Three formulations containing rotenone and a synergist were also tested. The methods of spraying the cattle were similar to those described for the previous tests. The results of examinations for larvae made seven days after spraying, which are comparative only, as the interval did not allow of maximum mortality, are summarised in a table. Statistical analysis showed that the addition of a wetting agent significantly increased the effectiveness of rotenone whether sulphur was present or not, the particle size of the sulphur, within the range 5·9–8·3μ, did not influence effectiveness, sulphur did not significantly increase the effectiveness of derris [*cf.* **34** 97], and derris of 5 per cent. rotenone content was about half as effective when used at 5 lb. per 100 U.S. gals. water as at 10 lb. It also confirmed that *H. bovis* is more resistant to insecticides than is *H. lineatum* [**38** 3]. Piperonyl butoxide and N-octyl bicycloheptene dicarboximide did not increase the effectiveness of rotenone.

GERRY (B. I.). **Control of a Salt Marsh Tabanid by Means of residual DDT-Oil Spray.**—*J. econ. Ent.* **42** no. 6 pp. 888–890, 1 graph, 1 ref. Menasha, Wis., 1949.

Tabanus nigrovittatus, Macq., which breeds in salt marshes, hinders the expansion of seaside resorts along the coast of Massachusetts. An investigation on its bionomics and control was therefore made in 1946–48, and control operations based on the findings were organised in three towns constituting a 15-mile section of shore-line in 1949. Larvae hatching near the lateral ditches close to the upland were found to migrate to higher elevations as they matured, and those hatching in wet depressions migrated to the less moist periphery. Migrating larvae tended to concentrate in the section of the marsh reached only by high tides, and 94 per cent. were on the portion that lay within 200 ft. of the upland. The adults began to emerge during the last week of June, were most abundant during the last fortnight of July and the first week of August, and then became scarce, though a few persisted until September.

The areas in which control tests were made and the strip in which control measures were established are described, and descriptions are also given of equipment and materials. The measure used was application from the air of a spray solution of DDT in oil (1 lb. per U.S. gal.) with the addition of 1 per cent. by weight aluminium stearate. The aluminium stearate increased the duration of effectiveness of deposits and increased coverage on smooth surfaces tenfold [*cf. R.A.E.*, A **35** 123]. In the tests, treating all salt marsh within half a mile of individual recreational areas with about 1·7 lb. DDT per acre from an aeroplane in mid-July to provide a barrier in which the migrating flies would be killed reduced the numbers of flies in the protected area by 90 per cent. However, as nearly all larvae were found within 200 ft. of the inner margin of the marsh, only a strip of this width was treated in 1949. Two applications of 1 lb. DDT per acre were made by helicopter, on 11th–12th and 21st–22nd July. This reduced the population of flies by 95 per cent. and maintained control throughout the season.

HOFFMAN (R. A.) & LINDQUIST (A. W.). **Effect of Temperature on Knockdown and Mortality of House Flies exposed to Residues of several Chlorinated Hydrocarbon Insecticides.**—*J. econ. Ent.* **42** no. 6 pp. 891–893, 4 refs. Menasha, Wis., 1949.

The following is substantially the authors' summary. The effect of temperature on the speed of knockdown of house-flies (*Musca domestica*, L.) exposed to deposits of several chlorinated hydrocarbons was determined by exposing flies to the deposits continuously at constant temperatures of 70 and 90°F., and the effect on mortality was determined by exposing them for predetermined periods (1–20 minutes) at 70 or 90°F. and then keeping them for 24 hours at the temperature at which they were exposed.

DDT, DDD (dichlordiphenyldichlorethane) and methoxy-DDT (methoxychlor) consistently caused more rapid knockdown and greater mortality at 70 than at 90°F. The reverse was true with heptachlor [1(or 3a), 4, 5, 6, 7, 8, 8-heptachlor-3a,4,7,7a-tetrahydro-4,7-endomethanoindene], parathion, chlordan, dieldrin [1, 2, 3, 4, 10, 10-hexachlor-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4, 5, 8-diendomethanonaphthalene] and toxaphene.

HOFFMAN (R. A.), ROTH (A. R.) & LINDQUIST (A. W.). **Effect of Air Temperature on the insecticidal Action of some Compounds on the Sheep Tick and on Migration of Sheep Tick on the Animal.**—*J. econ. Ent.* **42** no. 6 pp. 893–896, 1 graph, 4 refs. Menasha, Wis., 1949.

Laboratory tests to determine whether the difference between summer and winter temperatures in the United States influenced the effectiveness of certain chlorinated hydrocarbon insecticides against *Melophagus ovinus*, L., on sheep were made during the winter of 1948–49. Adults of *Melophagus* were exposed for a time (usually 120 minutes) at 70 or 90°F. on patches of woollen cloth that had been impregnated with the technical compounds from acetone solutions and were then kept for 20 hours at the temperature at which they had been exposed. Of the six compounds, DDT, methoxy-DDT (methoxychlor) and DDD (dichlordiphenyldichlorethane) caused considerably higher mortality at 70°F. than they did at 90°, and the reverse was true of BHC, toxaphene and chlordan.

Because of these differences, it is important to know the temperatures of the fleece and the optimum temperatures sought by the keds. Their movements were studied on two sheep that were subjected to fluctuating temperatures. Both had a fleece length of 4 ins. It was found that the keds remained on the skin at air temperatures of about 35°F. and below (when the skin temperature was about 90°) but might be found a short distance from the skin at somewhat higher temperatures and on the outer surface of the wool at 80–90°F. when the skin temperature was about 100°. The maximum number that appeared on the surface at any one time was rather less than half of the total number on the sheep. In controlling *M. ovinus* by means of sprays, it is important to take advantage of this outward migration. This can be done by spraying during the warmer months.

Furman (D. P.) & Bankowski (R. A.). **Absorption of Benzene Hexachloride in Poultry.**—*J. econ. Ent.* **42** no. 6 pp. 980–982, 11 refs. Menasha, Wis., 1949.

BHC (benzene hexachloride) has been shown to be effective in the control of several species of lice affecting fowls and against *Dermanyssus gallinae*, Deg. [*R.A.E.*, B **37** 118–119, 157, 203], but according to some workers it tainted the flesh and eggs of the fowls. Tests were accordingly carried out to determine whether or not BHC was absorbed from variously treated roosts, using a more sensitive method of detection than taste. Chickens about 6 weeks old were exposed in houses in which unpainted roosts had been drenched with an oil solution of 0·5 per cent. γ BHC, an aqueous suspension of technical BHC at rates giving 0·5–2·4 per cent. γ isomer, or an aqueous suspension containing 2·4 per cent. γ BHC without other isomers. After stated intervals, birds were killed, and the amounts of BHC in their tissues (skin, flesh and liver) were estimated (as parts γ isomer equivalent per million) by a bioassay method [*cf.* **37** 172]. This consisted in chloroform extraction of tissues and removal of interfering extractives with sulphuric acid, followed by a standardised exposure of house-flies [*Musca domestica*, L.] to the evaporated extract. Tissue extracts from two birds of the same group that had not been exposed to treated roosts were not toxic to house-flies. No BHC was demonstrated following the use of preparations containing 0·5 per cent. γ isomer, except for a very slight amount present in the skin of one bird two days after treatment. When suspensions containing 1·2 per cent. γ isomer or more, with or without other isomers, were used, BHC was present in each of the tissues examined after exposure for 2, 14 or 21 days. It very rarely persisted after 42 days. The greatest quantity found was equivalent to 8·65 parts γ isomer per million. This was in the skin after exposure for two days. Concurrent taste and odour tests were essentially negative.

Hoffman (R. A.). **Effect of several Insecticides on Sheep Tick Pupae.**—*J. econ. Ent.* **42** no. 6 p. 984, 1 ref. Menasha, Wis., 1949.

As the pupal period of *Melophagus ovinus*, L., often lasts a month or more [*R.A.E.*, B **1** 225], an insecticide that would destroy pupae as well as adults would be desirable. Laboratory tests of certain insecticides against the pupae were therefore carried out in Oregon in 1948. Puparia collected from heavily infested sheep were dipped in suspensions containing 0·5 per cent. DDT, DDD (dichlordiphenyldichlorethane), benzene hexachloride, methoxy-DDT (methoxychlor), toxaphene or chlordan, 0·01 per cent. parathion, or 0·006 per cent.

rotenone as cubé. Each suspension was tested with and without the addition of a wetting agent (5 per cent. Triton X-100). The surplus fluid was allowed to drain from the dipped puparia, and these were then divided into two batches, one of which was kept at room temperature (65–80°F.) and the other in a constant temperature of 80°F. Percentage emergence of adults from untreated pupae was 31 at room temperature and 45 at 80°. None of the dips affected emergence appreciably except possibly methoxy-DDT with the wetting agent, which reduced the percentage to 14 at room temperature and 25 at 80°F., and parathion at 80°F. which reduced it to 10 and 5 with and without the wetting agent, respectively.

GJULLIN (C. M.). **Laboratory Tests with various new Insecticides against the Sheep Tick.**—*J. econ. Ent.* **42** no. 6 pp. 984–985. Menasha, Wis., 1949.

In comparative tests in Oregon of the effectiveness of some 20 insecticides against *Melophagus ovinus*, L., adults collected from sheep were exposed on patches of wool cloth that had been impregnated with known amounts of insecticide by dipping in acetone containing it. After the acetone had evaporated, the patches were placed in 100-cc. beakers, and the insects were exposed on them for 30 minutes at about 70°F. The beakers were kept in the current of air from a small fan to reduce fumigating effects. In the first series of tests, only three of the insecticides, parathion, the γ isomer of BHC (benzene hexachloride) and dieldrin [1, 2, 3, 4, 10, 10-hexachlor-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4, 5, 8-diendomethanonaphthalene] gave complete mortality in 24 hours on cloth treated at 25 mg. per sq. ft. or less, and only two others, heptachlor [1 (or 3a), 4, 5, 6, 7, 8, 8-heptachlor-3a, 4, 7, 7a-tetrahydro-4, 7-endomethanoindene] and aldrin [1, 2, 3, 4, 10, 10-hexachlor-1, 4, 4a, 5, 8, 8a-hexahydro-1, 4, 5, 8-diendomethanonaphthalene] caused over 90 per cent. mortality. Mortality among controls was only 3 per cent. The less effective insecticides included DDT, DDD (dichlordiphenyldichlorethane), methoxy-DDT (methoxychlor), chlordan, BHC, toxaphene and rotenone as 5 per cent. cubé powder. The five insecticides that caused at least 90 per cent. mortality were retested at lower dosages, again with an exposure period of 30 minutes. Parathion, the most effective, caused complete mortality at 1·5 mg. per sq. ft., dieldrin gave 82 per cent. kill at 2·5 mg. and heptachlor, aldrin and γ BHC, all at 5 mg., gave 79, 76 and 75 per cent. kill, respectively.

JENKINS (D. W.). **A Field Method of marking Arctic Mosquitoes with Radiophosphorus.**—*J. econ. Ent.* **42** no. 6 pp. 988–989, 2 refs. Menasha, Wis., 1949.

The following is substantially the author's summary. Pools containing fourth-instar larvae and pupae of *Aëdes pullatus*, Coq., and *A. excrucians*, Wlk., were treated with radioactive phosphorus as $KH_2P^{32}O_4$ at 0·2–0·3 microcuries per ml. water, under arctic field conditions at Great Whale River, Quebec. Highly radioactive larvae, pupae and adults were produced. The average radioactivity of the adults was 1·44 milliroentgens per hour or about 4,300 counts per minute. It is suggested that the production of radioactively marked mosquitos in nature by this method would be useful in studies of dispersal and flight range and other ecological work.

MARCH (R. B.) & METCALF (R. L.). **Development of Resistance to organic Insecticides other than DDT by Houseflies.**—*J. econ. Ent.* **42** no. 6 p. 990, 1 ref. Menasha, Wis., 1949.

Strains of house-flies [*Musca domestica*, L.] that have developed resistance to DDT [*cf. R.A.E.*, B **38** 93, etc.] have become widespread in southern

California, but have been well controlled with BHC (benzene hexachloride) in wettable powders at concentrations giving about 0·25 per cent. γ isomer in the sprays. On an experimental scale, sprays containing 0·125–0·25 per cent. technical dieldrin [1, 2, 3, 4, 10, 10-hexachlor-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4, 5, 8-diendomethanonaphthalene] in the form of a 25 per cent. wettable powder were equally effective, showing high toxicity and long residual activity. However, in August 1949, it was reported that BHC was failing to give satisfactory control of *M. domestica* on a poultry ranch. Following unsatisfactory control by the deposit from 300 U.S. gals. spray containing 2·5 per cent. DDT applied in March, 300 and 600 U.S. gals. 0·25 per cent. γ BHC were applied in April and May and the deposits gave satisfactory control for four and three weeks, respectively, but following application of 850 U.S. gals. of the same spray to the whole ranch in July, the fly population returned to pre-spraying level in five days, and a further application in August of 150 U.S. gals. 0·75 per cent. γ BHC to a part of the ranch failed to give control for three days in the treated area. In the same month, 300 U.S. gals. 0·25 per cent. dieldrin was applied, but infestation was heavy in the treated area 2–3 days later.

A sample of flies was taken from the Pollard ranch and the resistance of the laboratory-reared progeny to various insecticides was compared with that of a highly DDT-resistant field strain (the Bellflower strain) and a laboratory strain without previous exposure to insecticides. The results are given in a table. The two field strains were about equally resistant to DDT, and the Pollard strain was three times as resistant to γ BHC and 28 times as resistant to dieldrin as the Bellflower strain. Compared with the laboratory strain, the Pollard strain was 300 times as resistant to DDT, 22 times as resistant to γ BHC and 45 times as resistant to dieldrin. The three strains were about equally resistant to parathion. It is evidently impracticable to control house-flies with deposits of DDT, γ BHC or dieldrin where strains comparable in resistance with the Pollard strain exist. There is no evidence that resistant strains become more susceptible following periods in which they are not exposed to the insecticide in question. The Bellflower strain has been reared in the laboratory for over 28 generations without exposure to DDT and with no appreciable change in resistance to it [*cf.* **38** 88].

THOMSON (R. C. M.). **Notes on the Breeding Habits and early Stages of some Muscids associated with Cattle in Assam.**—*Proc. R. ent. Soc. Lond.* (A) **22** pt. 10–12 pp. 89–100, 31 figs., 8 refs. London, 1947.

On the basis of observations made in 1938–41, notes are given on the oviposition or larviposition habits and morphology of eggs and larvae of certain Muscids that breed in cow dung in the plains of Assam. The adults of two of them, *Siphona* (*Lyperosia*) *exigua*, de Meij., and *Musca inferior*, Stein, suck the blood of the cattle, and some other species of *Musca*, including *M. crassirostris*, Stein, feed on open sores, but most were rarely seen elsewhere than on dung. The larvae of all the species of *Musca* studied and those of *Morellia hortensia*, Wied., and species of *Orthellia* were reared on a diet composed exclusively of dung, whereas those of *Anaclysta flexa*, Wied., could not be reared on dung only, but fed on full-grown larvae of a species of *Musca*. Larvae of *Xenosia ungulata*, Stein, and *Gymnodia distincta*, Stein, resemble those of *Anaclyste* in buccopharyngeal armature and so probably have the same food requirements.

CHORLEY (T. W.). *Glossina pallidipes* **Austen attracted by the Scent of Cattle-dung and Urine (Diptera).**—*Proc. R. ent. Soc. Lond.* (A) **23** pt. 1–3 pp. 9–11. London, 1948.

Having observed in Uganda that *Glossina morsitans*, Westw., congregates in large numbers at elephants' resting-places 24–48 hours after the elephants have left, when the scent is strongest, and is comparatively scarce on the trail approaching the resting-place, where the scent is much fainter, and having further made the same observations with regard to *G. pallidipes*, Aust., and buffalo resting-places and *G. pallidipes*, *G. palpalis*, R.-D., and *G. brevipalpis*, Newst., and those of hippopotamus, the author tested the attractiveness of baits of cattle dung and urine to *G. pallidipes* in the field in June 1943. Six shelters of grass and branches (to protect the baits from rain) were erected 200 yards apart on a very unproductive fly-route, and alternate shelters were baited. After a fortnight, the baits were transferred from the baited shelters to the previously unbaited ones. Catches were made over a total period of six weeks. The results wholly confirmed the earlier observations. Markedly more flies were taken in baited than in unbaited shelters, even when the baits had recently been moved. When the weekly catches in adjacent pairs of shelters were compared, the catch in the baited shelter was the greater in two pairs in all weeks and in the third pair in all weeks except the fourth. It is concluded that the sense of smell is of much greater importance in enabling tsetse-flies to locate their hosts than is generally believed. The results suggest that they probably follow a big-game track by scent alone.

STENBURG (R. L.). **The Techniques of Application and the Control of Roaches and Bedbugs with DDT.**—*Publ. Hlth Rep.* **62** no. 19 pp. 669–681, 5 refs. Washington, D.C., 1947.

Experiments to develop an effective method of applying DDT for the control of *Blattella germanica*, L., and *Periplaneta americana*, L., were carried out in houses, hospitals, restaurants and other commercial establishments in Georgia. Sprays consisting of emulsified solutions of DDT in xylene and a dust of 10 per cent. DDT in pyrophyllite were used. Before any applications were made, premises were classified into four groups according to infestation, ranging from severe to negligible. Sources of infestation are briefly discussed. Satisfactory results were obtained when infested rooms were sprayed with 5 per cent. DDT to deposit 200 mg. DDT per sq. ft. and the dust was then applied to all the cracks from which cockroaches had been driven by the spray [*cf.* *R.A.E.*, B **37** 131]. Special attention was given to areas where food was stored or served. Severe infestations of *B. germanica* were reduced in a week, the greatest mortality occurring within the first three or four days. Four weeks after application, there was no evidence of infestation in 16 out of 24 premises treated, while infestations of *P. americana* were practically eliminated in a week. Results of tests are given in tables. They show that there was still no evidence of either species 16 weeks after treatment. Sprays containing 2·5, 5, and 10 per cent. DDT applied at 100, 200, and 400 mg. DDT per sq. ft., respectively, to rooms of infested houses (without supplementary applications of dust), caused considerable mortality, especially of *Periplaneta*, but severe infestations of *B. germanica* persisted throughout the duration of observations. Multiple spraying gave slightly better results, but the method was impracticable in most premises, as furniture and walls were drenched. The use of the dust without a spray caused mortality of both species, but whereas infestations of *P. americana* were reduced considerably after a week and were negligible after three weeks, *B. germanica* persisted. *P. americana* was observed to travel greater distances from its resting places than *B. germanica* and was therefore more likely to acquire a toxic dose of DDT. *P. americana* entering a house from outside was controlled by an application of 5 per cent. DDT spray and the dust to outside breeding places, and of the dust to the surrounding ground.

The toxicity of DDT to bed-bugs [*Cimex lectularius*, L.] was investigated by treating five groups of infested houses with solutions of DDT in various solvents and at concentrations ranging from 2·5 to 35 per cent. DDT. Extent of treatment ranged from spraying only the mattress in the first group to the entire house and furniture in the fifth group. Complete control resulted within a week after application with all methods used, including mattress treatment with only 2·5 per cent. DDT, and was maintained for the remainder of the 16 weeks' observation period.

Scudder (H. I.). **A new Technique for Sampling the Density of Housefly Populations.**—*Publ. Hlth Rep.* **62** no. 19 pp. 681–686, 1 pl., 2 graphs, 2 refs. Washington, D.C., 1947.

Estimates of populations of house-flies (*Musca domestica*, L.) are required for the evaluation of control measures, but it is not possible to count all individuals, and random samples are not representative, as the flies tend to congregate in certain attractive positions. Bait-traps are unsatisfactory because it is difficult to find baits of uniform and constant attractiveness, and the sphere of influence of a bait varies with atmospheric conditions and counter-attractants. No method so far tried has met with general approval.

A new technique devised in Georgia for estimating populations is described. A "fly grill" three feet square was constructed of unplaned strips of board $\frac{3}{4}$ in. wide and tacked $\frac{3}{4}$ in. apart on a frame. The open structure allowed the flies free movement and did not interfere with the attractiveness of the area on which it was placed. To facilitate the counting of the flies, the grill was divided into quarters by black lines and the strips were tipped with black at alternate ends in groups of three. A grill 18 ins. square composed of strips $\frac{1}{4}$ in. wide and $\frac{1}{4}$ in. apart was also made for use in premises for which the larger one was too conspicuous. The grills were placed in positions where concentrations of flies were observed, and the flies present were gently disturbed and allowed to settle again. The number resting on a grill 30 seconds later was used as an approximate density value for that position. During the first season, as many as five counts were made at each position, the flies being disturbed between each count. The highest count obtained was taken as the value for that position. The proper statistical techniques to apply to the counts have not yet been determined with certainty. To obtain an index for a given establishment (such as a dairy), it was divided into zones and one or more grills were placed in each zone. The highest counts on individual grills in each zone were considered, and the four or five highest of these were averaged. In the case of towns, the data were dealt with in the same way, the average from a constant number of counts in a given block being used as an index for that area of the city. Control measures were instituted when the fly index of an establishment or area reached some arbitrary figure such as ten.

The indices obtained from the grill counts agreed with the known fact that an abundance of flies is associated with poor sanitation, and in 1946 very high grill indices were associated with the peak of the tomato-canning industry in certain cities in Texas in late June. The indices obtained in one dairy showed an increase in the fly population up to 20th June, when the dairy was sprayed with DDT. Monthly averages of indices thereafter until the end of October indicated that the flies were kept in control. The technique was also used successfully to estimate populations of blowflies, but more care was needed in making the counts to avoid disturbing them.

Harrison (C. M.). **D.D.T.-resistant House-flies.**—*Ann. appl. Biol.* **37** no. 2 pp. 306–308, 15 refs. London, 1950.

The literature on resistance to DDT in *Musca domestica*, L. [*cf. R.A.E.*, B **38** 134, 155, etc.] is reviewed, and a brief account is given of experiments in

England with flies of resistant and non-resistant strains received from Italy [**38** 129]. When flies of the two strains were exposed to deposits of DDT for one hour, the concentrations needed to give 50 per cent. kill in 24 hours were 158 and 40 mg. per sq. ft., respectively, so that one strain was about four times as resistant as the other, but after they had been maintained in the laboratory for six months without contact with DDT and after a further six months, when 26 generations had been bred, the resistant strain was only 1·5 and 1·2 times as resistant as the non-resistant one. Tests on the toxicity of γ BHC (benzene hexachloride) to these strains gave variable results, and neither was consistently more resistant than the other. However, the DDT-resistant flies were more resistant to pyrethrins than flies of the non-resistant strain. Resistance to DDT was appreciably increased after a very few generations by selective breeding, and a strain resistant to pyrethrins was reared in the same way. The pyrethrin-resistant strain was also more resistant to DDT than the non-resistant strain. Attempts to produce a strain of flies resistant to BHC from the non-resistant Italian strain by selection over five generations were unsuccessful. Wiesmann [**37** 216] related DDT-resistance to differences in the tarsi of the flies, but Bettini has shown that DDT-resistant flies are resistant to DDT when it is injected. Injection experiments on the two Italian strains corroborated Bettini's finding.

In the discussion that followed (pp. 308–309), F. G. S. Whitfield, A. H. Baker & G. F. M. Whitley [*i.e.* G. F. H. Whitney] described observations they had made on flies found at Stratford-on-Avon and Winchester that were much more resistant to DDT in aerosol form than a standard laboratory strain.

Joshi (K. G.) & Dnyansagar (V. R.). **Use of Crude Oil and Bleaching Powder in controlling Fly Breeding in Compost Trenches.**—*Indian med. Gaz.* **82** no. 2 pp. 93–96, 4 refs. Calcutta, 1947.

Observations in the Central Provinces and Berar showed that disposal of refuse and excreta in towns by composting, though affording satisfactory control of fly-breeding in summer and winter, permitted 10–20 per cent. of the pupae to give rise to adults in the rainy season [*R.A.E.*, B **35** 33]. The use of tarred hessian cloth to prevent this [**35** 1] is troublesome and requires close supervision, and since crude oil and bleaching powder [chloride of lime] rapidly killed fly larvae and pupae in the laboratory, practical tests with these were made.

Trenches 5×4×2 ft. were filled with refuse and excreta by the usual composting technique, and flies that emerged were trapped in nets above the trenches and counted daily until emergence ceased. Temperatures were recorded 9 inches below the surface and reached averages of about 45°C. [113°F.] in all trenches, after which they declined. Fly emergence from the untreated trenches reached its peak 10–14 days after composting and ceased after 18 days, and the total numbers of flies that emerged per trench averaged 1,434, which is not considered high and indicated that composting had checked breeding to some extent.

The crude oil was applied as a 25 per cent. emulsion and the bleaching powder as a 20 per cent. solution by sprinkling these evenly over the compost in the trenches. In the first test, the rates of application were 1 gal. oil and 10 lb. bleaching powder per 100 sq. ft., the trenches were treated on the day of composting, and the numbers of flies that emerged per trench in three weeks averaged 525 and 484, respectively. As, however, high fly emergence began about the tenth day both in the control and treated trenches, the effect of applying $\frac{3}{4}$ gal. crude oil or 6 lb. bleaching powder per 100 sq. ft. on the first and again on the eighth day after processing was tried. The two applications of oil reduced emergence to 170 and those of bleaching powder reduced it to 160, without interfering with biochemical decomposition in the trenches. Since bleaching powder rapidly deteriorates on storage during the monsoon, treatment with crude oil is recommended. Details of the methods of application and the cost of treatment are given.

KOEGEL (A.). **Nutztierparasitologie für Tierärzte, Landwirte und Nutztierhalter. Band I. Protozoologie und Entomologie unter Mitarbeit von Hermann Bollow.** [Parasitology of useful Animals for Veterinary Surgeons, Farmers and Keepers. Volume I. Protozoology and Entomology, with the Collaboration of Hermann Bollow.]—$9\frac{1}{2} \times 6\frac{1}{4}$ ins., vii+339 pp., 130 figs., 103 refs. Stuttgart, F. Enke Verlag, 1950. Price 30 *DM.* unbound ; 32.70 *DM.* bound.

This book is to consist of two volumes, of which this, the first, includes the sections on Protozoa and Arthropods. It refers mainly to conditions in Germany, and the useful animals considered are chiefly the usual farm livestock, fur-bearing animals, game, bees and silkworms. Mention is made of the Arthropod vectors of Protozoa. The section on Arthropods, which makes up nearly half the volume, is arranged systematically and includes information on the classification, appearance, development, hosts and importance as vectors of disease or otherwise of numerous individual species and on the control of species or groups. Some account is included of insects that are predacious or parasitic on pests and, for comparative purposes, of some Arthropods that attack man or occur in other countries.

SOPER (F. L.), DAVIS (W. A.), MARKHAM (F. S.) & RIEHL (L. A.). **Typhus Fever in Italy, 1943–1945, and its Control with Louse Powder.**—*Amer. J. Hyg.* **45** no. 3 pp. 305–334, 16 figs., 4 refs. Lancaster, Pa., 1947.

An account is given of the development and successful control of the typhus epidemic in Naples in 1943–44 [*R.A.E.*, B **37** 223], with a weekly analysis of civilian cases, which totalled over 1,400 in the city between July 1943 and April 1944 and occurred chiefly during November–February. The measures instituted, apart from the isolation and care of the sick, were almost entirely dusting of people and their hats and clothes, without removal of the clothing [*cf.* **33** 194 ; **36** 180], with MYL (a pyrethrum preparation [**34** 45]) or DDT for the control of lice [*Pediculus humanus humanus*, L., and *P. h. capitis*, Deg.]. Contact or spot dusting (treatment of the members of a patient's family, other contacts and close associates) was the procedure first used, in mid-December 1943, and work was subsequently rapidly extended to include treatment of persons using air-raid shelters, mass treatment at various delousing stations in the town, treatment of all inhabitants of certain blocks of buildings where this appeared necessary, and treatment of contacts outside the city. Institutional delousing and delousing of military personnel and labour and of refugees were also carried out but are not discussed. Air-raid shelter treatment and station treatment were begun on 27th–28th December. The epidemic reached its peak in the week ending 26th December and then declined rapidly. The decline was in progress before mass dusting at stations could have had any effect. It is believed that dusting of contacts and close associates was an important factor in arresting and reversing the trend of the epidemic and that the more widespread treatments were probably useful supplements. Over three million individual treatments were made. Since most of the early work was done with MYL, this insecticide must be considered chiefly responsible for the early success of the campaign.

The technique and procedures recommended for applying louse powder in the event of subsequent outbreaks of typhus are described in some detail, and the distribution of cases of the disease in various parts of Italy between June 1944 and July 1945 is briefly described.

FULLER (H. S.). **Infestation of Man in Burma with Trombiculid Mites, with special Reference to** *Trombicula deliensis.—Amer. J. Hyg.* **45** no. 3 pp. 363–371, 16 refs. Lancaster, Pa., 1947.

An account is given of the experiments made in September 1945 in which it was found that *Trombicula deliensis*, Walch, probably an important vector of tsutsugamushi disease in Burma and Assam [*R.A.E.*, B **37** 91], attaches itself to man under natural field conditions in northern Burma [**37** 92]. The observations were made at a camp site where troops had apparently become infected in the previous year. The site is described. Two men and two penned rats were exposed on grass for six hours a day on five successive days. On the mornings following the first four days of exposure, mites were found on the rats but not on the men. On the morning following the fifth day of exposure, four mites, subsequently identified as *T. deliensis*, were found on one man. In each case, a stylostome had formed at the site of attachment. The man did not become ill, and blood taken on the tenth day after attachment did not show agglutinins for Proteus OX2, OX19 or OXK. The fact that only four mites were found attached to the man while over 50 attached themselves to the rats, although no choice of host was available and *T. deliensis* was shown by the subsequent exposure of monkeys (*Macaca mulatta*) to be numerous on the grass on which the men had been exposed, is taken to indicate that in Burma, *T. deliensis* attaches only reluctantly to man. The author does not believe that monkeys play any part in the dispersal of infected mites in nature, as they rapidly removed each other's mites when close enough to do so. The local effects of attachment by *T. deliensis* are discussed with reference to the literature. They appear to be very slight. In this experiment, the man was conscious of their presence, but there was probably no actual itching. There was no sign of local inflammatory reaction.

The occurrence of irritant Trombiculids and scrub itch throughout the world is reviewed. There are few records in the literature of irritation following attachment by Trombiculids in continental Asia. In this work, two species were identified that are known elsewhere to attack man on occasion, though these were not observed to do so in Burma. They were *T. acuscutellaris*, Walch, which was collected from a heron and has been recovered from man in Malaya [**20** 179] and *Eutrombicula* (*T.*) *wichmanni*, Oudm. [**37** 149], which was taken from several hosts including domestic fowls. The author states that he believes *E. wichmanni* to be the most acceptable name for the larvae to which McCulloch has applied the name *Trombicula minor*, Berl. [**34** 141, 143], those which Kohls *et al.* [**34** 146] have called *T. buloloensis*, Gunther, and those which Fletcher, Lesslar & Lewthwaite have called *T. pseudoakamushi*, Hatori non Tanaka [**16** 261]. The geographical distribution of scrub itch and tsutsugamushi disease are not mutually exclusive, and although scrub itch was not reported in Burma, future investigation may reveal its presence there.

SERGENT (Ed.) & SERGENT (Et.). **Une simple et radicale " grande mesure antilarvaire " contre les anophèles : le colmatage.**—*Arch. Inst. Pasteur Algérie* **24** no. 1 pp. 24–28, 1 fig. Algiers, 1946.

This paper on the way in which silt from flood water was used to reclaim a swamp in Algeria in which Anophelines were breeding is identical with one already noticed [*R.A.E.*, B **36** 53] except that it is stated that the process was begun in 1929 and completed in five years.

Parrot (L.) & Clastrier (J.). **Notes sur les phlébotomes. LI. Sur** *Phlebotomus langeroni*.—*Arch. Inst. Pasteur Algérie* **24** no. 1 pp. 60–65, 4 figs., 9 refs. Algiers, 1946.

Parrot (L.). **LII. Le rapport AIII/E.**—*T. c.* pp. 66–75, 5 refs.

Phlebotomus langeroni, Nitzu., the subject of the first paper, was described from Douar-Chott, near Tunis [*R.A.E.*, B **19** 57], and subsequently recorded from Cyrenaica and Morocco. Only males are known. In the autumn of 1943, one of the authors found five males in another locality near Tunis, and a redescription of the male is here given on the basis of these individuals and mounted specimens from Morocco.

In the second paper, the lengths of the third antennal segment (AIII) and of the epipharynx (E) and the ratio AIII/E are given for 80 Old-World species of *Phlebotomus*, some of them represented by several varieties, and the significance of these measurements is discussed. It is concluded that although the value for AIII/E varies from one individual to another in the same species, it is nevertheless a useful auxiliary means of identification and classification, at least for Old-World species, and should therefore be considered, even though it does not, alone, make a definite identification possible.

Sergent (Ed.) & Sergent (Et.). **Expériences de destruction des varrons (***Hypoderma bovis* **de Geer) par la poudre insecticide D.D.T.**—*Arch. Inst. Pasteur Algérie* **24** no. 2 pp. 110–111. Algiers, 1946.

A brief account is given of small laboratory and field experiments in Algeria in the winter of 1945–46 in which a solution of 5 per cent. DDT in kerosene was brushed on to the backs of cattle for the control of *Hypoderma bovis*, Deg. In the laboratory, two applications were made to the shaven back with an interval of five weeks and in the field two at an interval of one month to the unshaven back. Neither the solution nor kerosene alone harmed the cattle, but the treatment was not effective enough to be of value.

Parrot (L.) & Wanson (M.). **Notes sur les phlébotomes. LIII. Sur** *Phlebotomus gigas* **et sur** *Phlebotomus mirabilis*.—*Arch. Inst. Pasteur Algérie* **24** no. 2 pp. 143–152, 9 figs., 4 refs. Algiers, 1946.

Wanson (M.) & Lebied (B.). **L'habitat des phlébotomes cavernicoles de Thysville (Congo Belge).**—*T. c.* pp. 153–156, 2 figs., 1 ref.

Parrot (L.) & Habibi (A.). **Notes sur les phlébotomes. LIV. Formes anormales de** *Phlebotomus minutus* **var.** *parroti* **Adler et Theodor.**—*T. c.* pp. 157–159, 3 figs.

In the first paper, redescriptions are given of both sexes of *Phlebotomus gigas*, Parr. & Schwetz, and *P. mirabilis*, Parr. & Wns., based on material collected at the type locality, a cave at Thysville in the Belgian Congo, in 1945.

This cave, in which *P. gigas* was taken in 1936, 1938 and 1945 and *P. mirabilis* in 1938 and 1945, is described in the second paper ; it is the cave in which *Anopheles vanhoofi*, Wanson & Lebied, was discovered in 1945 [*R.A.E.*, B **34** 39]. The two sandflies never attacked man in it, nor could they be induced to do so in captivity. They apparently feed exclusively on bats. Though the finding of approximately equal numbers of males and females of both species indicated that the breeding places were close at hand, searching in bat guano and mud failed to yield larvae.

The third paper comprises descriptions of two anomalous adults of *P. minutus* var. *parroti*, Adl. & Thdr., taken at Algiers.

PARROT (L.) & GRAS (P.). **Notes sur les phlébotomes. LV. Phlébotomes du Fezzan.**—*Arch. Inst. Pasteur Algérie* **24** no. 3–4 p. 330, 2 refs. Algiers, 1946.

Phlebotomus papatasi, Scop., and *P. fallax*, Parr., are recorded from the Fezzan (Libyan Sahara). No dermal leishmaniasis was seen, but the presence of *P. papatasi* makes its occurrence in the region seem probable.

BALL (G. H.). **Attempts to cultivate the Mosquito Phase of** *Plasmodium relictum*.—*Amer. J. trop. Med.* **27** no. 3 pp. 301–307, 4 figs., 15 refs. Baltimore, Md., 1947.

The following is substantially the author's summary. In an endeavour to bring about the development *in vitro* of the sporogonic cycle of *Plasmodium*, attempts were made to culture the oöcysts of *P. praecox* (*relictum*) on the stomachs of *Culex tarsalis*, Coq. A number of media, including completely synthetic ones, were tested. Various mixtures of gases were introduced into the flasks, in some cases continuous aeration was employed, in others a modified rocker type culture was used. Mosquito tissue remained alive with hind-gut contraction for at least seven days and the oöcysts persisted apparently unaltered for six days, but no development of them could be demonstrated.

WOKE (P. A.). **Arthropods of sanitary Importance in the Republic of Nicaragua, Central America.**—*Amer. J. trop. Med.* **27** no. 3 pp. 357–375, 1 map, 6 refs. Baltimore, Md., 1947.

The author gives a list of upwards of 120 species of Arthropods that are of actual or potential medical or veterinary importance in the Republic of Nicaragua or are related to such important species or associated with them, based on a nine months' survey of chosen localities in the summer of 1943 and certain other records. They include five species of *Anopheles* and over 30 other mosquitos, 15 Muscoid flies, 13 Tabanids and four ticks. Distribution within the Republic and habitats are indicated. The probable vectors of the prevailing Arthropod-borne diseases are discussed. Malaria, amoebic dysentery and myiasis due to *Dermatobia hominis*, L. jr., are widespread. Bacillary dysentery, typhoid, muco-cutaneous leishmaniasis and probably filariasis caused by *Filaria* (*Wuchereria*) *bancrofti* also occur. There has been no epidemic of yellow fever since 1921 ; the reintroduction of infection would be serious as *Aëdes aegypti*, L., is abundant.

FLOCH (H.) & ABONNENC (E.). **Distribution des anophèles en Guyane française.**—*Publ. Inst. Pasteur Guyane* no. 144, 9 pp., 1 map, 10 refs. **Distribution des moustiques du genre** *Culex* **en Guyane française.**—*Op. cit.* no. 146, 8 pp., 2 refs. **Distribution des culicinés des genres autres que le genre** *Culex*, **en Guyane française.**—*Op. cit.* no. 148, 12 pp., 1 map, 2 refs. Cayenne, 1947.

In the first of these papers, a list is given of the 21 Anophelines known to occur in French Guiana ; the number of times that each has been taken is shown, and notes are given on distribution and sometimes on habits. The presence of all in French Guiana has already been recorded [*R.A.E.*, B **36** 191, etc.] with the exception of *A. kompi*, Edw., a single male of which was taken in forest in 1945. The most plentiful species were *Anopheles aquasalis*, Curry, *A. darlingi*, Root, and *A. pessôai*, Galvão & Lane. The importance of the first two as vectors of malaria has been discussed in earlier publications [**34** 57–59]. *A. pessôai* attacks man, but attempts to infect it experimentally failed.

The 49 species of *Culex* and 90 species of other mosquitos known from French Guiana are similarly dealt with in the second and third papers, respectively.

Floch (H.). *Triatoma rubrofasciata* **de Geer naturellement infecté par** *Trypanosoma conorrhini* (**Donovan**) **en Guadeloupe.**—*Publ. Inst. Pasteur Guyane* no. 147, 3 pp., 2 figs., 4 refs. Cayenne, 1947.

Records of the occurrence of *Trypanosoma conorhini* in *Triatoma rubrofasciata*, Deg., are reviewed from the literature [*cf. R.A.E.*, B **35** 124 ; **37** 43, etc.], the finding of this trypanosome in the dejecta of a female of *T. rubrofasciata* from Guadeloupe is recorded, and the metacyclic forms of *Trypanosoma conorhini* are compared with those of *T. cruzi*.

Abbott (P. H.). **The Culicidae (Diptera) of Darfur Province, Anglo-Egyptian Sudan, with Observations on the Geography and Zoogeographical Relations of the Region.**—*Proc. R. ent. Soc. Lond.* (B) **17** pt. 3–4 pp. 37–48, 1 map, 10 refs. London, 1948.

The geological features, rainfall and vegetation of Darfur, the most westerly province of the Anglo-Egyptian Sudan, are described, and a list is given of mosquitos recorded from it. They include nine species of *Anopheles*, among which *A. gambiae*, Giles, is widespread and the only important vector of malaria. One larva of *A. funestus*, Giles, is the only example of this species that has been taken. *Aëdes aegypti*, L., is widely distributed, and careful control of it was necessary during the war, as the aerodrome at El Fasher was the last port of call, in the area where yellow fever is endemic [*R.A.E.*, B **37** 94], for aircraft proceeding to India and the Far East. The mosquitos of the Marra mountains in the centre of the province belong predominantly to the East African highland type, with other essentially temperate species. It is thought that these species may have been widely spread over north-eastern Africa in early times, when there were probably periods when the climate was much wetter and cooler than it is at present.

Papers noticed by Title only.

Gillogly (L. R.). **Interference of Sulphur with Bioassay Dip Test** [using *Musca domestica*, L., for evaluation of insecticides].—*J. econ. Ent.* **42** no. 6 pp. 983–984. Menasha, Wis., 1949. [See *R.A.E.*, A **38** 372.]

Dahm (P. A.) & Pankaskie (J. E.). **A biological Assay Method for determining Aldrin** [by tests on *Musca domestica*, L.].—*J. econ. Ent.* **42** no. 6 pp. 987–988, 6 refs. Menasha, Wis., 1949. [See *R.A.E.*, A **38** 373.]

ROBERTS (F. H. S.), O'SULLIVAN (P. J.), RUMBALL (P.) & McLAUGHLAN (A. W.). **Observations on the Value of DDT for the Control of the Poultry Stickfast Flea,** *Echidnophaga gallinacea* **Westwood.**—*Aust. vet. J.* **23** pp. 148–152, 2 refs. Sydney, 1947.

The distribution of *Echidnophaga gallinacea*, Westw., in Queensland [*R.A.E.*, B **31** 122; **35** 131] has been confined to a fairly small area to the south-west of Brisbane by strict quarantine and by weekly treatments of all poultry, cats and dogs with red-oil emulsion (1 : 3). The emulsion kills the fleas but does not prevent reinfestation after 48 hours. *E. gallinacea* has been taken on certain wild birds in the area, but as it has spread only a few miles in five years, it is concluded that these play only a small part in its dispersal.

Following a report of the successful use of DDT dust against *E. gallinacea* on dogs [**32** 205], the possibility of eradicating the flea with DDT was investigated. In preliminary trials, a 10 per cent. dust applied to the head and neck of infested fowls killed the fleas but gave no lasting protection. In October 1945, batches of five heavily infested fowls were completely immersed in dips containing 0·5, 1, 2 or 4 per cent. DDT as an emulsified solution in solvent naphtha or had the head and neck treated with them. An examination of some birds of each batch two hours after treatment showed that all the fleas had been killed. The 40 treated birds and 25 heavily infested control birds were penned together at night and kept under observation for eight weeks. The emulsion proved very toxic to the fowls. The entire bodies of all the birds that had been immersed were scalded, especially the breast and the undersurface of the wings, and 5, 2, 1 and 4 died after immersion in 4, 2, 1 and 0·5 per cent. DDT, respectively. Some deaths occurred as late as 3–6 weeks after treatment. Birds that lingered showed trembling and uncoordination of movement typical of DDT poisoning. Treatment of the head and neck only was followed by marked scalding of the combs and wattles, and nearly always severe otitis, but did not cause death. It was concluded that emulsions prepared from solvent naphtha and similar solvents are not safe for use on poultry. The birds that survived immersion in 2, 1 and 0·5 per cent. DDT remained free from infestation by *E. gallinacea* for 8, 5 and 2 weeks, respectively. Those that had had the head and neck dipped in 4 and 2 per cent. DDT remained free for 3 and 2 weeks, respectively, while those similarly treated with 1 and 0·5 per cent. became reinfested in the first week. All the fowls were moderately to heavily infested at the end of the trial with the exception of those dipped in 2 per cent. DDT. The control birds remained heavily infested throughout.

Trials were next made with a commercial preparation containing 50 per cent. p,p′ DDT which on melting and pouring into water forms a fine and stable suspension [*cf.* **36** 101]. When 180 fowls were immersed in a suspension of 2 per cent. DDT in March 1946 [**35** 131], 1–12 fleas were found to have survived on the heads of three birds four days later, through failure to wet the area thoroughly, and eight that were heavily infested had evidently missed treatment, as many of the birds roosted in the trees and were difficult to muster. Infestation on these 11 birds gradually disappeared, and the entire flock was free from infestation in the 14th week and remained so until the 23rd week, when four birds had one flea each. By the 34th week, when the observations were concluded, 12 birds were infested with 1–3 fleas each.

A flock of 60 birds on another farm was completely immersed in the 2 per cent. DDT suspension, and after removing litter, the fowlhouse floor was sprayed with it at 1 pint per 15 sq. ft.; the spray penetrated into the top $\frac{1}{4}$ inch of soil. Infestation disappeared until the 8th week, when one flea was seen. This had disappeared three weeks later, and all birds were still uninfested in the 34th week. The fowlhouse was well constructed, and all birds were penned at night. Treatment of the floor only, in another fowlhouse containing 120 infested birds, gave no significant decrease in the flea population over eight weeks. Infestation on untreated control birds remained moderate to heavy. The average numbers of fleas per bird (index of fleas emerging) between treatments with red-oil emulsion (1 : 3) from June to October, on six fowls treated weekly for the first three months and thereafter fortnightly, ranged from 0·5 to 18·5.

Trials designed to determine effective strengths of the suspension for complete immersion, carried out on fowls and ducks, showed that 2 per cent. DDT gave longer protection than 0·5 or 1 per cent. There were no deaths or symptoms of toxicity among the treated birds, but during a control campaign on several farms, toxic effects and death occurred under conditions that suggested that overheating of the birds before treatment and slow drying after it might be dangerous. Eggs were tainted through DDT being carried into the nests.

Infested dogs washed in suspensions containing 0·5, 1 and 2 per cent. DDT became free from infestation and remained so for 2, 7 and 3–16 weeks, respectively. Cats dipped in 0·5 per cent. DDT remained free of fleas for seven weeks, but became very ill, and those dipped in 1 per cent. DDT all died.

The long periods of protection obtained with suspensions of 1 and 2 per cent. DDT were taken as indications that the flea might be eradicated from Queensland by their use.

LAIRD (M.). **Some natural Enemies of Mosquitoes in the Vicinity of Palmalmal, New Britain.**—*Trans. roy. Soc. N. Z.* **76** pt. 3 pp. 453–476, 10 figs., 35 refs. Wellington, N. Z., 1947.

The following is almost entirely based on the author's summary of this account of observations on the value of various aquatic Arthropods and some other animals as agents in the natural control of mosquitos made during a mosquito survey at Palmalmal, Jacquinot Bay, New Britain, in 1945. The two Anophelines found were *Anopheles punctulatus*, Dön., which bred chiefly in temporary pools that had no predacious macrofauna, and *A. farauti*, Lav., which bred chiefly in permanent ones [*R.A.E.*, B **37** 232]. The findings indicated that larvae of *Culex halifaxi*, Theo., and of Zygoptera and adults of *Gyrinus sericeolimbatus*, Rég., the Hygrobatid mite, *Limnesia jamurensis*, Oudm., and perhaps of various species of Gerrids are among the most effective predators of Anopheline larvae. The Dytiscids, *Hydaticus litigiosus*, Rég., and *Copelatus* sp., the Notonectid, *Enithares bergrothi*, Mont., and *Orthetrum villosovittatum*, Br., and other Anisoptera are of less value against Anophelines, but they feed extensively on other mosquito larvae. Spiders of the genera *Epeira* and *Meta*, which spin webs over breeding pools, are of some importance as predators on adult mosquitos, as also are bats and the house gecko, *Gehyra oceanica*. *Megarhinus inornatus*, Wlk., which breeds in coconut husks and small artificial containers, might be used for the control of members of the group of *Aëdes scutellaris*, Wlk., as their immature stages occur in the same type of breeding places [*R.A.E.*, B **37** 129]. It is the only predator discussed in this paper that may be of more than purely local importance.

The introduction of *Enithares bergrothi* into metal tanks and drums in the Jacquinot Bay area should provide a means of controlling domestic species when other methods are undesirable. It is pointed out that there may be enough predators in certain permanent pools to maintain effective control of Anophelines, and that treatment of these pools with such larvicides as DDT would probably destroy the predators and, unless treatment was repeated frequently, allow Anophelines to establish themselves in pools that had formerly been of little importance.

Arnason (A. P.), Brown (A. W. A.), Fredeen (F. J. H.), Hopewell (W. W.) & Rempel (J. G.). **Experiments in the Control of** *Simulium arcticum* **Malloch by Means of DDT in the Saskatchewan River.**—*Sci. Agric.* **29** no. 11 pp. 527–537, 1 pl., 1 map, 3 refs. Ottawa, 1949.

In 1948, two experiments with sprays of DDT applied from an aeroplane against Simuliid larvae [*cf. R.A.E.*, B **38** 88, 143] were made on the South and North Saskatchewan rivers for the control of *Simulium arcticum*, Mall., which often causes serious mortality of livestock in late May and June [**37** 122]. The characteristics of the rivers are described. Spraying was carried out when 85 per cent. of the larvae were in the first or second instar. In the first test, which was made on the South Saskatchewan in the early morning of 25th May, 440 gals. spray consisting of 615 lb. technical DDT in a mixture of Velsicol AR-50 and fuel oil (1 : 9), with 0·5 per cent. Triton X-100 and a dye, were applied in 16 runs each of nine seconds duration, over a period of 36 minutes, giving a concentration of 0·13 part DDT per million in the water passing during that period. The treated strips fused at the first rapids two miles downstream, and three miles further on, the DDT content of the treated water was found to vary from 0·01 to 0·09 p.p.m., owing to dilution. The concentration was highest at the front of the film and in the middle of the river. Elimination of the larvae from rapids in which they had been numerous was almost complete for 17 miles from the point of application, and complete 50 miles downstream where submerged willows had been heavily infested. Only four larvae were found at a distance of 90 miles, but this area had not been examined before treatment. Two days after spraying, no Simuliid larvae were found in any rapids for more than 100 miles below the point of application. An apparent reduction of 47 per cent. in the larval population at a station 4·9 miles above the point of application was thought to be due to a sampling error.

Attacks on livestock by adults in June were considerably reduced in the vicinity of the treated area, though they remained heavy in untreated areas. The rapids at the upper end of the treated section became repopulated with mature larvae, which had migrated from infested rapids upstream, within a fortnight, and by 27th July the entire treated section was repopulated with larvae of the next generation. Fish were not affected by the treatment, but other aquatic insects were temporarily reduced in numbers, though not eliminated.

The second test was made on the North Saskatchewan on 1st June, when 390 gals. spray containing 545 lb. DDT were applied in 34 minutes, giving a dosage of 0·07 p.p.m. DDT. Accurate counts could not be made, but there was little apparent effect on Simuliid larvae and none on fish.

Bouvier (G.). **Répartition des ecto-parasites des Bovidés dans le canton de Vaud.**—*Mitt. schweiz. ent. Ges.* **20** pt. 7 pp. 686–688, 1 map, 6 refs. Berne, 1947.

Examination of hair, skin scrapings and crusts from cattle in the canton of Vaud, Switzerland, showed the presence of the mange mites, *Sarcoptes bubulus*, Oudm. (*scabiei*, auct.), which was recorded in Switzerland for the first time in 1945, and has since been found in nine cantons in the west and north, *Chorioptes bovis*, Gerl., which was fairly frequent, and *Demodex bovis*, Stiles, and the lice, *Haematopinus eurysternus*, Nitzsch, *Linognathus vituli*, L., *Solenopotes capillatus*, End., and *Damalinia* (*Trichodectes*) *bovis*, L. Their local distribution is shown on a map.

Büttiker (W.). **Beitrag zur Kenntnis der Biologie und Verbreitung einiger Stechmückenarten in der Schweiz.** [Contribution to the Knowledge of the Biology and Distribution of certain Species of Mosquitos in Switzerland.]—*Mitt. schweiz. ent. Ges.* **21** pt. 1 pp. 1–148, 46 figs., 102 refs. Berne, 1948.

The mosquitos dealt with are *Culex pipiens*, L., *Aëdes vexans*, Mg., *A. geniculatus*, Ol., *Anopheles claviger*, Mg. (*bifurcatus*, auct.) and *A. maculipennis*, Mg. In the introduction, the systematics and importance of mosquitos are discussed, and notes are given on the world distribution and bionomics of the five species concerned. The only varieties of *A. maculipennis* found by the author in Switzerland were *typicus*, *messeae*, Flni., and *melanoon*, Hackett ; their local distribution is given, together with the dimensions and patterns of the eggs.

Observations on the effect of abiotic factors on development and behaviour were carried out in the laboratory in 1946 and 1947, and the results are discussed with reference to the literature. The breeding technique is described in detail. Hens and guineapigs were the main sources of blood-meals, and date-pulp in a little water was found to be an excellent supplementary diet. Ground dog biscuits and powdered liver proved suitable food for the larvae.

The following is mainly based on the author's summary of the results. At 18°C. [64·4°F.], the minimum preoviposition periods of *C. pipiens* and *A. m. messeae* lasted 5 and 3·5 days. At 22°C. [71·6°F.] development from hatching to adult emergence lasted 10·4, 10, 18·3 and 16·7 days for *C. pipiens*, *Aëdes vexans*, *A. geniculatus* and *Anopheles maculipennis*, respectively. Records of the duration of development of mosquitos from individual batches of eggs showed that males of *C. pipiens* and *A. m. messeae* begin to emerge 1–1·5 and 2 days before the females. Temperature preferences differed with stage and species. Thus, larvae of *C. pipiens* congregated in sections of a thermal gradient in which the temperature of the water was 21–25°C. [69·8–77°F.], those of *A. m. typicus* preferred 21°C., and those of *A. claviger* 20–23°C. [68–73·4°F.]. The temperature preference did not change in the course of larval development. The adults of *C. pipiens* preferred temperatures of 30–32°C. [86–89·6°F.] in summer and 2–6°C. [35·6–42·8°F.] in winter. The effect of temperature on the activity of larvae, pupae and adults of the different species was similar, and the curves representing it agreed fairly closely. None of the larvae or pupae survived freezing in water, but the larvae of *A. claviger*, which is a cold water species, showed slight activity at 0°C. [32°F.] and considerably more at 4–8°C. [39·2–46·4°F.].

Unfed females of *C. pipiens* and *A. m. messeae* lived longest (about 4 and 12 days, respectively) at −2 to 2°C. [28·4–35·6°F.] and 100 per cent. relative humidity. At 5°C. [41°F.] and 100 per cent. humidity, unfed freshly emerged females of *A. m. messeae* lived for 10 days, and those fed on fruit juices lived for 40 days. Overwintered females of *C. pipiens* transferred at the end of February to a temperature of 17–18°C. [62·6–64·4°F.] all died in 36 hours when the relative humidity was 7–8 per cent., but survived until April or May when it was 100 per cent. Overwintered females of *A. m. messeae* survived from March to July–September when kept at 100 per cent. relative humidity and a temperature of −2 to −3°C. [28·4–26·6°F.].

Details are also given on the effects of different types of electro-magnetic radiation on the larvae of *A. maculipennis*, on the phototactic reactions of larvae, pupae and adults of *C. pipiens* and *A. m. messeae*, and on the depths to which larvae of the various species could dive when disturbed and the periods for which the larvae and pupae could remain below the surface of the water.

Floch (H.). **L'endémo-epidémie palustre en Guyane française.**—*Publ. Inst. Pasteur Guyane* no. 163, 12 pp., 8 refs. Cayenne, 1947.

On the basis of malaria surveys made in 1946 in some areas and in earlier years in others [*R.A.E.*, B **34** 60], the various indices of the prevalence and intensity of malaria in man in various localities in French Guiana are given and discussed. Notes on seasonal fluctuation in malaria incidence are included. The predominant parasite was *Plasmodium falciparum* ; it was more than four times as abundant as *P. vivax*, and *P. malariae* was rare.

A list is given of the 21 species of *Anopheles* found in French Guiana with the number of each taken [**38** 163], and the relative importance as malaria vectors of the two most abundant, *A. darlingi*, Root, and *A. aquasalis*, Curry, is indicated [**34** 58]. In 1947, *A. darlingi* was found for the first time breeding in Cayenne [*cf.* **34** 57].

THOMSON (R. C. M.). **Recent Knowledge about Malaria Vectors in West Africa and their Control.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 5 pp. 511–527, 26 refs. London, 1947.

This review of recent work on the vectors of malaria (principally *Anopheles gambiae*, Giles, and *A. melas*, Theo.) in Sierra Leone and Nigeria (with brief reference to conditions in the Gold Coast and Gambia) comprises accounts of investigations on the status and relative importance of the two Anophelines [*R.A.E.*, B **34** 5 ; **36** 97–99, etc.], their breeding places and control [**33** 201 ; **34** 5–7 ; **35** 4–6 ; **36** 65–66 ; **37** 197–198], and the relation between reduction in Anopheline population and malaria incidence [**37** 95]. In a village near Lagos, Nigeria, in which *A. gambiae* and *A. melas* occurred together in considerable numbers in the houses throughout most of the year, the mean sporozoite rates found in them were 11·1 and 4·5 per cent., respectively. The combined figures for all localities studied in the Lagos area were 10 and 3·5 per cent. At certain times, exceptionally high rates were found in small samples of *A. gambiae*. The highest figures for any one month were 29 per cent. for *A. gambiae* and only 8 per cent. for *A. melas*. Although the rates in *A. gambiae* are much higher than those in *A. melas*, the latter is also a very efficient vector, and the combination of the two is formidable.

An unsuccessful attempt to control *A. gambiae* in pools in rocky stream beds in Sierra Leone by flushing is described. Dams and sluice gates were installed at the upper parts of streams, and a turbulent flood was produced that swept the stream bed from bank to bank, but the larvae were washed from their pools to the calmer water at the edge where they lay submerged until the flood subsided. About an hour after flushing, there were large numbers of full-grown larvae and pupae in the stream bed. Larvae of *A. gambiae* were shown in the laboratory to survive complete immersion for four hours. When the number of flushings was increased to three per week and an additional sluice was added to give a double flush, a heavy growth of vegetation developed in mid-stream, affording extra shelter for the larvae.

MCARTHUR (J.). **The Transmission of Malaria in Borneo.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 5 pp. 537–558, 1 map, 5 refs. London, 1947.

All the principal findings recorded in this detailed account of the investigations that led to the incrimination of *Anopheles leucosphyrus*, Dön., as the vector of malaria in North Borneo have already been noticed from a much briefer source [*R.A.E.*, B **36** 203]. The larvae of this Anopheline, which have the power to remain submerged for over five minutes, occurred only in clear spring water with an acid reaction (pH 6–6·4) in the presence of dead leaves, in seepages at the stream-heads under dense jungle shade [*cf.* **37** 175]. Conventional methods of control, such as oiling, dusting with Paris green and drainage are economically impracticable ; moreover, Paris green applied weekly failed to give control after the first few weeks in a small experiment, as it was washed away by heavy rain. Cutting the jungle growth was also ineffective if débris was left in place, but complete clearing, with burning of the débris, for quite a short distance around dangerous seepages (generally about 30 feet) caused the immediate cessation of breeding in every case. Only partial clearing for quite a short distance with the admission of cattle to graze also resulted in the immediate control of *A. leucosphyrus*, the effect being accelerated by the pollution of the water by the cattle. Prevention of regeneration by the grazing made the control permanent. The clearings favoured cultivation and housing, and the making of grassy lanes along the course of streams for grazing and access to the jungle was a simple means of control and benefited the inhabitants.

EDDEY (L. G.). **Destruction of Adult Mosquitoes by residual DDT Methods.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 5 pp. 567–588, 8 graphs, 1 ref. London, 1947.

In preliminary trials carried out in large numbers of native houses at Takoradi in the Gold Coast Colony, it was found that a 1 per cent. solution of DDT in kerosene, applied to walls and ceilings to give a calculated deposit of 38·5 mg. DDT per sq. ft., markedly reduced the numbers of mosquitos in the treated rooms. Nine weeks after a single spraying, the ratio of mosquitos infesting the treated rooms to mosquitos infesting the control rooms was still only 2 : 5. When the dosage was reduced to 11·9 mg. DDT per sq. ft. and ceilings were not sprayed, the 2 : 5 ratio was reached in 13 days and infestation in treated and control rooms was the same in 28 days.

In a large trial in a semi-rural area (Apowa), where no routine measures against the larvae were being applied, sprays of 19·75 mg. DDT per sq. ft. kept the number of mosquitos in rooms in the treated section of the village below that in rooms in the untreated section for nine months. Dead mosquitos were collected in the treated rooms for ten weeks between check sprayings with pyrethrum. The mosquitos collected were mostly Anophelines, and of these nearly all were *Anopheles gambiae*, Giles, and *A. funestus*, Giles, the former predominating.

In view of these results, spraying with 1 per cent. DDT to leave a toxic residue of about 20 mg. per sq. ft. was adopted in 1945 as the routine Anopheline control measure in and around Takoradi township in place of spraying twice weekly with pyrethrum in kerosene [*R.A.E.*, B **33** 201]. There was an immediate and considerable reduction in the number of mosquitos collected after the first application of spray at 19·3 mg. DDT per sq. ft. in March–April, and the control was maintained for 10–11 weeks between the first and second and the second and third applications and for 18 weeks after the third. Moreover, the normal direct relationships between rainfall and all species of mosquitos collected, and between rainfall and Anophelines [*loc. cit.*] ceased. As at Apowa, the Anophelines were almost exclusively *A. gambiae* and *A. funestus* with the former predominating. Brief notes are given on labour organisation and costs, including a comparison of costs in village sections as compared with the central township. DDT was much more economical than sprays that had to be used frequently.

HOCKING (K. S.). **The residual Action of DDT against** *Anopheles gambiae* **and** *funestus*.—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 5 pp. 589–601, 2 refs. London, 1947.

Accounts are given of the methods used and results obtained in experiments made near Taveta, Kenya, with tents, mud huts and wooden traps, on the action of deposits of DDT from kerosene solutions against mosquitos (predominantly *Anopheles gambiae*, Giles, and *A. funestus*, Giles). The initial mortality caused and the duration of effectiveness with various dosages of

DDT on different surfaces are recorded. Counts in the morning showed that the percentages of mosquitos killed followed fairly closely the dosage used, the initial mortalities given by 200, 100 and 50 mg. DDT per sq. ft. ranging from 72 to 93, 50 to 82 and 43 to 57 per cent., respectively. The persistence of toxicity varied widely and seemed to be related most closely to the nature of the treated surface. It was greatest in tents, 200 mg. remaining effective for a year. On two occasions, a period of heightened toxicity was found to correspond with one of considerable rain or humidity. Though fewer mosquitos were caught in the morning in treated than in control huts and tents, the results obtained with traps indicated that this was not due to any inhibitory effect of the DDT, as entry was little reduced. All-night catching showed that females were not reluctant to feed in treated quarters.

It is concluded that *A. gambiae* and *A. funestus* tend to leave a lightly treated structure, but that with a deposit of about 200 mg. per sq. ft., final mortality approaches 100 per cent. and the effect lasts for at least 4–6 months on most surfaces, unless lime is present [*cf. R.A.E.*, B **36** 69, etc.]. Treatment with this dosage over a sufficiently large area should greatly reduce malaria transmission by *A. gambiae* or *A. funestus*.

VANDERPLANK (F. L.). **Experiments with DDT on various Species of Tsetse Flies in the Field and Laboratory.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 5 pp. 603–620, 6 refs. London, 1947.

To be of use against *Glossina*, an insecticide must have lasting effect, be lethal after short contact and be stable in the presence of heat and sunlight. DDT was the first insecticide found to fulfil these requirements. Consideration of various methods by which it might be applied with a view to eradicating *Glossina* from isolated infested areas led to the choice, mainly on economic grounds, of the use of concentrations of treated cattle in excess of the game present [*cf. R.A.E.*, B **37** 176]. Brief descriptions are given of simple laboratory tests typical of many in which deposits of DDT were shown to be lethal to all of 13 species and forms of *Glossina* from different parts of Africa, though they differed in susceptibility to it. Experiments with various solutions and emulsions containing DDT indicated that a deposit consisting of numerous small crystals was more effective than one consisting of large crystals, the total weight of DDT per unit area being the same. However, large crystals were effective for a longer time. Tsetses that had been in contact with DDT on a treated surface for a few seconds ceased probing and attempted to clear their legs of the irritating particles ; they then flew off.

The effectiveness of DDT preparations in the field was tested in Tanganyika by marking and releasing examples of *G. pallidipes*, Aust., and *G. swynnertoni*, Aust., taken on treated and control oxen and on treated and untreated screens and comparing the percentages of each group subsequently recaptured by nets. Results are given in tables. Screens treated with DDT in carbon tetrachloride and carried about in the bush lost their effectiveness in three days. An emulsion was therefore devised to make the crystals adhere better. It consisted of equal parts of kerosene containing 5 per cent. DDT (77 per cent. active isomer) and fresh ox serum to which 0·5 per cent. sodium arsenite had been added as a preservative. This killed about 92 per cent. of the flies on oxen on the day of application and gave complete mortality on the next day. It was then less effective but gave significant results five days after application. Treated pieces of ox hide remained completely effective in the laboratory three months after application, and treated screens also remained effective for much longer than the animals, as they were less exposed to friction. The next two experiments were made with an emulsion in which diesel oil was used as the solvent for DDT instead of kerosene and a 5 per cent. gum solution instead of serum.

As the diesel oil was not so volatile as kerosene, the gum solution evaporated first, leaving an oily film over the gum crystals and defeating the principle of the adhesive. The emulsion gave 73 per cent. mortality on oxen during the first week and 60 per cent. during the second week, while treated screens still gave significant results in the third week. Field and laboratory observations on the screens showed that the effectiveness of the DDT was reduced when the screens were wet.

ADLER (S.). **The Behaviour of a Sudan Strain of** *Leishmania donovani* **in** *Phlebotomus papatasii*. **A Comparison of Strains of** *Leishmania*.—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 5 pp. 701–712, 1 pl., 15 refs. London, 1947.

The following is mainly based on the author's summary. Sandflies (*Phlebotomus papatasi*, Scop.) were infected with a strain of *Leishmania donovani* from the Sudan by feeding on suspensions of flagellates from cultures or of leishmania forms from the spleens of infected Syrian hamsters [*Cricetus auratus*]. In sandflies infected on cultures containing 200–1,000 flagellates per 0·1 cu. mm., the infection tended to die out in a few days. In those fed on suspensions of leishmania forms, estimated to contain 500,000 per 0·1 cu. mm., permanent infections were established and the flagellates reached the buccal cavity after three days. Sandflies fed on heavily infected hamsters either did not become infected or developed a slight infection that did not extend significantly to the anterior position. Flagellates from *P. papatasi* that had been infected by feeding on a leishmania suspension, produced a generalised infection in two Syrian hamsters into which they were injected intracutaneously, but 49 heavily infected sandflies failed to transmit the infection to four normal hamsters by feeding.

Whereas all known artificial media that are suitable for one strain of *Leishmania* are equally suitable for any other strain, the midguts of different species of sandflies show a specific selectivity for special strains. The behaviour in *P. papatasi* of various strains of *L. tropica*, *L. donovani* and *L. infantum* is discussed [*cf. R.A.E.*, B **19** 121, 217 ; **23** 123 ; **26** 256, 257 ; **27** 108]. *P. papatasi* appeared to have an active, natural immunity against the Sudan strain of *L. donovani*, but this was broken down by massive doses.

PARROT (L.) & DURAND-DELACRE (R.). **Notes sur les phlébotomes. LVI. Phlébotomes de Beni Ounif-de-Figuig (Sahara oranais).**—*Arch. Inst. Pasteur Algérie* **25** no. 1 pp. 77–86, 5 figs., 35 refs. Algiers, 1947. **LVII. Présence en Algérie de** *Phlebotomus clydei* **Sinton, 1928.**—*T.c.* no. 3–4 pp. 210–211, 7 refs.

It is stated in the first of these papers that the presence of sandflies (*Phlebotomus*) in Beni Ounif-de-Figuig, an oasis in the Algerian Sahara on the southern slopes of the Atlas mountains some 640 miles from Oran, was first recorded in 1908, the occurrence of a local cutaneous eruption frequent among Europeans recently arrived in the region was later attributed to them, and indigenous cases of cutaneous leishmaniasis were reported in 1932–33. A list is given, with collection records and notes on distribution in southern Algeria and possible importance, of seven species of *Phlebotomus* (175 examples) taken indoors in systematic night and day catches in the summer and autumn in 1945 and 1946. The species of the subgenus *Phlebotomus* included are *P. papatasi*, Scop., the first species identified in the district, *P. sergenti*, Parr., *P. alexandri*, Sinton, and *P. longicuspis*, Nitzu. *P. minutus* var. *parroti*, Adl. & Thdr., has been known from the area since 1934 but was not taken during the survey. Both sexes of *P. squamipleuris* var. *dreyfussi*, Parr., are redescribed from material from Beni Ounif.

In the second paper, the taking of one male and three females of *P. clydei*, Sinton, at light in Beni Ounif-de-Figuig in July and August 1947 is recorded. This species was not previously known to occur in Algeria.

SENEVET (G.). *Anopheles tonkinensis* **synonyme de** *A. alongensis.*—*Arch. Inst. Pasteur Algérie* **25** no. 3–4 pp. 214–217, 5 refs. Algiers, 1947.

The characters of the larvae of *Anopheles alongensis*, Venhuis [*R.A.E.*, B **28** 128], of which only this stage was known, and of *A. tonkinensis*, Galliard & Ngu [**29** 199], are compared from the original descriptions, and it is concluded that these larvae, all of which were taken from dark caves in the rocks of the Bay of Along, Tonkin, belong to a single species. Consequently, *A. tonkinensis* becomes a synonym of *A. alongensis*, which has some months' priority.

MARGALEF (R.). **Observaciones sobre el desarrollo de la vida en pequeños volúmenes de agua dulce y sobre la ecología de las larvas de** *Aëdes aegypti.* Observations on the Development of Life in small Volumes of soft Water and on the Ecology of the Larvae of *A. aegypti.*]—*Publ. Inst. Biol. apl.* **3** (1946) pp. 79–112, 10 figs., 10 tables (6 fldg.), 28 refs. Barcelona, 1947. (With a Summary in English.)

In studies in Barcelona on the ecological requirements of larvae of *Aëdes aegypti*, L., the author exposed vessels containing distilled or tap water in a sunny situation in March 1946, added peptone to one series and observed the succession of organisms that developed in them. The succession is described at length. The first Dipterous larvae to appear were Psychodids, followed by Ceratopogonids. Larvae of *A. aegypti* were observed 50–120 days after the addition of peptone, when there was a considerable amount of oxygen and organic matter present and a rich nanoplankton for them to feed on. They are known to disappear when the nanoplankton is replaced by microplankton, but this stage had not been reached when breeding was arrested by the fall in temperature in November.

RINGS (R. W.) & HILL (S. O.). **The taxonomic Status of** *Aedes mathesoni* (**Diptera, Culicidae**).—*Proc. ent. Soc. Wash.* **50** no. 2 pp. 41–49, 3 figs., 11 refs. Washington, D.C., 1948.

The scale patterns of the adults and the chaetotaxy of the larvae of *Aëdes mathesoni*, Middlekauff [*R.A.E.*, B **33** 84] and *A. canadensis*, Theo., are compared, and it is concluded that *mathesoni* is a melanistic geographical variation of *A. canadensis*. It occurs in Florida, Alabama, Georgia and South Carolina. In this area, with the exception of southern Florida, the ranges of the two subspecies overlap and intergrades are frequent.

JACOBSON (M.) & HALLER (H. L.). **The insecticidal Component of** *Eugenia haitiensis* **identified as 1,8-Cineol.**—*J. Amer. chem. Soc.* **69** p. 709, 7 refs. Easton, Pa., 1947.

A kerosene solution of the essential oil distilled from the leaves of *Eugenia haitiensis*, a tree reported to grow only in Haiti, is used there by the natives as a spray against mosquitos and other insects. In experiments, this oil gave complete knockdown and high mortality of house-flies [*Musca domestica*, L.] and mosquitos when tested without dilution, but showed low toxicity when applied in refined kerosene (1 : 1), though there was still complete initial knockdown. Fractional distillation of the oil under reduced pressure yielded three fractions, of which only that with the lowest boiling range was insecticidally active. This fraction, representing 86 per cent. of the oil, had the same order of toxicity as the original oil and was very similar in physical properties to 1,8-cineol (eucalyptol), which has been reported to comprise 78·5 per cent. of the oil distilled from the leaves of *E. buxifolia* in Porto Rico. It was shown to be identical with 1,8-cineol by preparation of the orthochlorphenol addition product and oxidation to *dl*-cineolic acid, and a commercial sample of 1,8-cineol after purification by distillation showed the same toxicity to house-flies as the toxic fraction isolated from the essential oil.

HARRISON (R. A.). **Laboratory Breeding of the Housefly** (*Musca domestica* **L.**).—*N.Z. J. Sci. Tech.* **30** (B) no. 4 pp. 243–247, 3 figs., 3 refs. Wellington, N.Z., 1950.

Details are given of modifications of the Peet-Grady method of rearing *Musca domestica*, L. [*R.A.E.*, B **37** 89, etc.] adopted in New Zealand in 1946–47. The breeding room was artificially lighted and was maintained at 27·8°C. [82°F.] and 53 per cent. relative humidity. The larvae were kept in jars 6 ins. in diameter and 6 ins. high, and the adults in cubic galvanised wire gauze cages with sides 12 ins. long. Liquid food for the adults was supplied in glass test tubes that had a feeding hole about one inch in diameter near the closed end, plugged with cotton-wool. The tube was held horizontally in the side of the cage by means of a large cork and had a cork stopper through which a piece of bent glass tubing passed, allowing the food to soak through to the surface of the cotton-wool. Oviposition tubes were fitted in the same way in cages containing breeding stocks and served for both feeding and egg laying. They had a large, longitudinal opening (about 1×4 ins.), plugged with cotton-wool, and the tubing was omitted so that the cotton-wool did not remain too moist. Adult flies were fed on milk powder, water and sugar. The formula was 17·5 gm. powdered whole milk, 200 ml. distilled water and 7 gm. sugar for breeding stock and 50 gm. powdered skimmed milk, 300 ml. distilled water and 12·5 gm. sugar for test flies, the latter with the addition of 0·4 ml. formalin if the food was to be used for more than 24 hours. The larval medium was made of locally available materials and was similar to that used in the United States [*loc. cit.*].

Four or more cages, each with 500–700 adults, were maintained for breeding. Each was kept 14 days for egg production and then replaced by a cage of newly emerged flies. Food was supplied in oviposition tubes each morning, and egg laying began after about 12 hours, when the surface of the cotton-wool was sufficiently dry. The eggs were removed from the tubes each morning and placed in water, and 0·3 ml. eggs was then picked up with a pipette and placed with 10 ml. water in a shallow pit on top of the medium in each larval breeding jar. Larvae pupated in numbers on the sixth day, and pupae were taken from the culture on the ninth day. To facilitate separation of the pupae from the medium, a petri dish 3½ ins. in diameter and ½ in. deep and having the bottom covered to a depth of ⅛ in. with a flat pad of well moistened non-absorbent cotton-wool was buried ½ in. beneath the surface of the medium before the eggs were transferred to it. When ready to pupate, the larvae worked their way through the cotton-wool, which became fluffy, rose to the surface of the medium and within two days attained the size of a tennis ball. On the ninth day it was removed, and the petri dish full of pupae was taken from the jar. Pupae from the five dishes of one culture were mixed, counted (by weight) and distributed to cages for emergence. The pupae were very clean, and collecting and sorting took only a few minutes. From 60 to 90 per cent. of the larvae pupated in the dishes. Pupae in the medium were discarded. Adults began to emerge 10–11 days after a culture was started, and most emerged on the 14th day. The appropriate food mixture was supplied each morning. At the week-end, both test and breeding flies were fed with the skimmed milk powder formula containing formalin.

Mackerras (I. M.) & Mackerras (M. J.). **Revisional Notes on Australasian Simuliidae (Diptera).**—*Proc. Linn. Soc. N. S. W.* **73** pt. 5–6 pp. 372–405, 20 figs., 24 refs. Sydney, 1949.

Wharton (R. H.). **New Species of Simuliidae (Diptera, Nematocera) from New South Wales.**—*T. c.* pp. 406–412, 21 figs., 2 refs.

The first paper comprises a review of Australasian Simuliids, based mainly on a re-examination of Tonnoir's extensive collection in the Division of Economic Entomology, Council of Scientific and Industrial Research, in the light of Smart's revision of the family [*R.A.E.*, B **35** 96]. The authors recognise 20 species and three subspecies of Simuliids in Australia and Tasmania, four species in New Guinea and seven species in New Zealand. One species is common to Australia and New Guinea. The New Guinea species all belong to *Simulium*, as restricted by Smart and those from New Zealand to *Austrosimulium*; both these genera and *Cnephia* are represented in Australia. The three genera are redefined, notes are given on the morphology and bionomics of the Australian and New Guinea species, their synonyms are recorded and their distribution in Australasia is shown. Keys are also given for separating the females, and the males and larvae where known, of the Australian and New Guinea species (but not subspecies). As the authors have nothing to add to Tonnoir's keys and descriptions [**13** 47], the New Zealand species are omitted from the keys, and the notes on them are very brief. One new subspecies, *A. torrentium hilli*, is described from Australian Capital Territory and New South Wales. Of species described by Tonnoir [**13** 47], *A. simile* and *A. weindorferi* are considered synonyms of *A. furiosum*, Skuse, and *A. tasmaniense* of *A. victoriae*, Roub.

In the second paper, which supplements the first, *S. melatum*, sp. n., is described from New South Wales, additional notes are given on *A. crassipes*, Tonnoir, including a description of the female and immature stages, and an unknown Simuliid larva is described but no name assigned to it.

Woodhill (A. R.). **Observations on the comparative Survival of various Stages of *Aëdes* (*Stegomyia*) *scutellaris* Walker and *Aëdes* (*Stegomyia*) *aegypti* Linnaeus at varying Temperatures and Humidities.**—*Proc. Linn. Soc. N. S. W.* **73** pt. 5–6 pp. 413–418, 5 refs. Sydney, 1949.

Aëdes scutellaris, Wlk., is the common vector of dengue in the territory of Papua-New Guinea [*cf. R.A.E.*, B **37** 181-182], but the vector in Australia is *A. aegypti*, L. [**32** 82], which has been recorded as far south as southern New South Wales. As, however, a form or subspecies [*katherinensis*, Woodhill (see next abstract)] of *A. scutellaris* has recently been recorded in the Northern Territory of Australia, the question arises whether *A. scutellaris*, if introduced into Queensland or New South Wales, could establish itself and become an important vector of dengue there. Experiments were therefore carried out to determine the relative viability of *A. aegypti* and *A. scutellaris* under winter and summer conditions in Sydney and under the colder conditions that prevail in exposed situations in inland parts of New South Wales during the winter.

The following is substantially the author's summary of the results. Even under optimum conditions of temperature and humidity (80°F. and 70–80 per cent. relative humidity), only 5–20 per cent. of eggs of *A. scutellaris* that had been on a wet surface for two days remained viable after about 80 days in the dry state [*cf.* **37** 129–130], whereas 58–80 per cent. of the eggs of *A. aegypti* survived under similar conditions. Under natural conditions of temperature and humidity throughout the winter, spring and early summer in the Sydney district, all eggs of *A. scutellaris* were killed when allowed to remain dry for about 80 days, while 46–83 per cent. of eggs of *A. aegypti* hatched. Eggs of *A. scutellaris* exposed for three days to 34°F. were not significantly affected, but exposure to 40°F. for 14 days killed a significantly larger proportion of the eggs of *A. scutellaris* than of those of *A. aegypti*.

Larvae of *A. scutellaris* were killed by exposure to 40°F. for 48 hours, whereas those of *A. aegypti* were not adversely affected. All pupae and adults of *A. scutellaris* were killed by exposure to 40°F. for 72 hours, whereas 15–22 per cent. of the pupae and a large proportion of the adults of *A. aegypti* survived. Females of both species were more resistant to cold than males.

The results indicated that *A. scutellaris* requires tropical conditions and would not establish itself permanently in subtropical or temperate zones where *A. aegypti* is commonly found. The present known distribution of the two species conforms with this view. In attempts to cross males of each species with females of the other, copulation apparently took place and some hundreds of eggs were laid, but none of these was fertile.

A statistical note by D. B. Duncan confirming the significance of the data is appended.

Woodhill (A. R.). **A new Subspecies of** *Aëdes* (*Stegomyia*) *scutellaris* **Walker (Diptera, Culicidae) from northern Australia.**—*Proc. Linn. Soc. N. S. W.* **74** pt. 3–4 pp. 140–144, 4 figs., 4 refs. Sydney, 1949.

Until 1944, no member of the *scutellaris* group of *Aëdes* [*cf.* next abstract] had been recorded from Australia. In December of that year and in January 1945, R. H. Wharton collected three females and one male at Batchelor in the Northern Territory, resembling *A. scutellaris*, Wlk., but differing from it in femoral markings, and in January 1948, A. E. Wynn collected a batch of eggs at Katherine, Northern Territory, that gave rise to adults similar to those collected by Wharton. The large number of adults bred from this stock showed a constant variation from typical *A. scutellaris* in the marking of the mid-femora but were identical as regards the male genitalia and in all other respects, and there were no differences in the characters of eggs, larvae and pupae. The adults of both sexes are therefore described as *A. scutellaris katherinensis*, subsp. n. The material studied included two females from the extreme north of Western Australia. The synonyms, type locality and distribution of *A. scutellaris scutellaris*, Wlk., are also given.

Woodhill (A. R.). **A Note on experimental Crossing of** *Aëdes* (*Stegomyia*) *scutellaris scutellaris* **Walker and** *Aëdes* (*Stegomyia*) *scutellaris katherinensis* **Woodhill (Diptera, Culicidae).**—*Proc. Linn. Soc. N. S. W.* **74** pt. 5–6 pp. 224–226, 1 map, 9 refs. Sydney, 1949.

As a result of recent studies of the *scutellaris* group of *Aëdes* [*R.A.E.*, B **34** 37 ; **37** 186], twelve forms have been recognised, full specific status being given to each. The author has also described a form from northern Australia as *A. scutellaris katherinensis*, Woodhill [see preceding abstract]. Knowledge of members of the group from the western part of its range (Celebes, Sumatra and the Andaman Islands) is not sufficient for a definite determination of their status. The distribution of the twelve well defined species and the recently described variety is shown on a map. So far as is known, they are similar in breeding habits and general ecology. With a view to further clarifying the relationship between them, attempts were made in the laboratory to cross *A. scutellaris scutellaris*, Wlk., from Lae, New Guinea, and *A. s. katherinensis*. The cultures were kept in cages measuring 12 × 10 × 10 ins., at 80°F. and 70–80 per cent. relative humidity and were supplied with raisins and given blood twice weekly. Crossing was carried out by caging some 50 males of one subspecies with a comparable number of females of the other. When the females were of the typical form, a normal number of eggs was laid and all hatched ; in due course, normal F_1, F_2 and F_3 generations of adults were obtained. On the other hand, when the females were of the subspecies *katherinensis*, pairing frequently took place and a normal number of eggs was laid, but these were completely sterile. There was no development of the embryo. Virgin females of *katherinensis* laid only a small number of sterile eggs, so the cross mating is shown to have stimulated oviposition. Morphologically, the F_1 adults of the fertile cross were intermediate between the parent subspecies, and the F_2 adults showed all degrees of intergradation. It is considered from these results that the retention of the two forms as subspecies is justified.

Laird (M.). **Reactions of Mosquitoes to the Aircraft Environment.**—*Trans. roy. Soc. N.Z.* **77** pt. 1 pp. 93–114, 26 refs. Wellington, N.Z., 1948.

The author summarises the literature on the behaviour and survival of mosquitos in aircraft and describes observations on their reactions during a flight from New Zealand to Japan and back and under simulated conditions. The following is based on his summary and conclusions. When exposed to reduced air pressures corresponding to those prevailing at altitudes of about 10,000–30,000 ft., males and females of *Aëdes notoscriptus*, Skuse, were sluggish and very rarely made voluntary flights. At pressures corresponding to those at about 30,000–40,000 ft., they did not fly even in response to contact stimuli and seldom moved about voluntarily, but would crawl a little in response to contact stimuli and showed a sluggish righting response when knocked off their balance. When exposed to a temperature of 10–12°C. [50–53·6°F.], they were somewhat sluggish in their movements. Fewer voluntary flights were made as the temperature fell, although brief flights were made in response to contact stimuli at temperatures down to 8°C. [46·4°F.]. The mosquitos would not fly, even in response to contact stimuli, at lower temperatures, and became inert and appeared dead at temperatures below 3°C. [37·4°F.] or if kept for long at 3–8°C. The life-span was not significantly shortened by exposure to vibration, sufficiently intense to prevent the mosquitos from resting, for periods of up to 24 hours and under various conditions of reduced air pressure and temperature. Exposure to the environment within the aircraft did not shorten life significantly, provided that the females were able to feed at normal intervals. Under laboratory conditions, males of *A. notoscriptus* survived for an average of four days after being deprived of food. This survival period did not vary on exposure to actual and simulated conditions of the aircraft environment. The average survival period of females under similar conditions was a little longer.

As males of *Culex pipiens pallens*, Coq., brought to New Zealand from Japan by air survived afterwards for an average of six weeks at winter temperatures, by analogy with known cases of the introduction of mosquitos into other countries, it is thought likely that foreign mosquitos could become established at least in the warmer parts of New Zealand if introduced from abroad by air. When travelling in aircraft, adults of *A. notoscriptus* and *C. p. pallens* flew about agitatedly when the motors were first fully opened out and for some five minutes afterwards, and also during and for a few minutes after landing. On being restored to normal pressure and temperature, *A. notoscriptus* rapidly recovered from the state of inactivity induced by exposure to reduced air pressures and temperatures.

It is concluded that the most favourable time for spraying in aircraft is immediately before turning into the wind for the take-off run ; a pyrethrum-base insecticide should be sprayed from an automatic system controlled from the instrument panel in the cockpit. Routine spraying with pyrethrum-base aerosols should be supplemented with treatment of all enclosed spaces with DDT to leave a toxic deposit. The protection of New Zealand, where no insect-borne diseases of man exist, against the introduction of noxious insects from abroad depends largely on the adequacy of control measures taken at overseas airports, but until strict insect control is compulsory at all international airports and until all aircraft flying to New Zealand are equipped with fully effective apparatus for insecticidal spraying, an adequately equipped mosquito-control organisation must be maintained at all New Zealand airports dealing with overseas traffic. The numbers of such airports should be kept as low as possible.

DESPORTES (C.) & CAMPANA (Y.). **Sur** *Ornithodorus tholozani* (**Laboulbène et Mégnin 1882**) **et sur les ornithodores de l'Asie centrale et mineure.**—*Ann. Parasit. hum. comp.* **21** no. 1–2 pp. 74–88, 3 figs., 19 refs. Paris, 1946.

Brumpt considered that the vector of relapsing fever near Babylon (Iraq) was a tick distinct from *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.), the vector in Russian Central Asia, and identified it as *O. asperus*, Warb. [*R.A.E.*, B **27** 239], a species known from an incomplete description of a single male [**7** 70]. Much material was reared from the three individuals collected by Brumpt, and the authors were impressed by its similarity to museum specimens of *O. tholozani* from Persia and to Birula's description of *O. papillipes* from the Caucasus. They compared it with material from Persia and Syria and conclude that the ticks from all these sources are typical *O. tholozani*, which they redescribe from adults of both sexes. They confirm that *O. papillipes* is identical with *O. tholozani*. They also conclude from a comparison of Pavlovsky's description of *O. papillipes* from Russian Turkestan and the characters of specimens from this area and from the Punjab that the ticks from Russian Central Asia and those from the Punjab represent varieties of *O. tholozani*. That from the Punjab is var. *crossi*, Brumpt [*cf.* **34** 89, etc.], and the other is named *pavlovskyi*, var. n. They consider *O. asperus* a species of doubtful identity. The life-cycles of the typical *O. tholozani* from Babylon and var. *pavlovskyi* from Ferghana (Turkestan) are compared, and an account is given of attempts to cross them. From ten females of the typical form and seven of var. *pavlovskyi*, allowed to engorge on guineapig and caged with males of the opposite variety, only one egg batch was obtained and only half of the eggs hatched. The resulting adults resembled the female parent (typical variety), but some were malformed. A few eggs were laid by one of the normal females but none hatched.

RISTORCELLI (A.). **Sur la zoophilie d'***Anopheles hispaniola.*—*Ann. Parasit. hum. comp.* **21** no. 1–2 p. 93, 2 refs. Paris, 1946.

The Anophelines of Marrakesh (Morocco) are *Anopheles maculipennis*, Mg., which breeds in irrigation channels in the southern part of the town, and *A. hispaniola*, Theo., which breeds in two watercourses in the northern part. These two watercourses are heavily charged with alluvial sand and clay and are abnormal breeding places for the species. It is thought that the adults that first became established in the locality arose from larvae washed down from the classical breeding places (gravel-bottomed, grassy streams) higher up the valley [*R.A.E.*, B **27** 117]. Larvae are usually found in stagnant backwaters with no vegetation and little other fauna. Their abundance appears to depend on the proximity of cattle sheds. These are usually about half a mile from the water, and at certain times of year, blood-fed females and females with developed fat-body are very numerous in them. *A. hispaniola* feeds on man and animals and seems to show little differentiation as regards food requirements, but strictly zoophilous biotypes might be found in stock-rearing areas.

Ross (H. H.). **The Mosquitoes of Illinois (Diptera, Culicidae).**—*Bull. Ill. nat. Hist. Surv.* **24** art. 1, [3+]96 pp., frontis., 184 figs., 32 refs. Urbana, Ill., 1947.

After general introductory notes on the biology, date of spring emergence, local distribution, economic importance and control of mosquitos in Illinois and methods of collecting, preserving, studying and rearing them, keys are given to the larvae and adults of the subfamilies of Culicids and of the ten genera and 52 species of true mosquitos (CULICINAE) represented in that State, and sometimes to the male genitalia also, together with the Illinois records, and data on the larval and adult morphology, habits, and sometimes prevalence and importance of each of the 52. The species of *Anopheles* are *A. barberi*, Coq., *A. crucians*, Wied., *A. punctipennis*, Say, *A. quadrimaculatus*, Say, and *A. walkeri*, Theo. Of these, only *A. quadrimaculatus* is considered capable of being an important vector of malaria, which is endemic in southern Illinois.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). Manual of Parasitology of Man. With a Discussion of the Theory of the Vectors of transmissible Diseases.** [*In Russian.*]—5th edn., 2 vols., $10\frac{1}{2} \times 7$ ins., 1022 pp., 36 pls. (10 col.), 618+figs., many refs. Moscow, Izd. Akad. Nauk SSSR, 1946–48. Price, vol. 1, 44 *rub.*, vol. 2, 43 *rub.*

This is a fifth edition of the author's comprehensive text-book on human parasitology in the Soviet Union [*cf. R.A.E.*, B **24** 202], the third and fourth editions of which appeared in a shortened form under other titles. The whole work has been revised and greatly expanded, but its scope and general plan have been maintained. It now comprises two volumes, of which the second is devoted to the section on Arthropods. The book contains information published up to about 1945, and in the introduction the author summarises the principal Russian advances in the field of parasitology since the appearance of the second edition. Most of those concerned with Arthropods have been noticed from individual papers in this *Review*. They include research in various parts of the Union on the tick vectors of relapsing fever [**31** 109; **34** 204, etc.], spotted fevers [**36** 177, etc.] and spring-summer encephalitis [**34** 67–71, etc.], the mosquito vectors of autumn (Japanese B) encephalitis [**31** 72; **37** 146–148], the numerous vectors of tularaemia [**27** 241; **31** 109; **34** 73–75, 112, etc.], the relation of sandflies (*Phlebotomus*) to disease [**26** 241; **35** 167, etc.], the ecology of sandflies [**36** 79; **37** 19, etc.] and their control [**33** 183; **34** 79, etc.], the flies associated with man [**34** 110], blood-sucking Diptera in general [**35** 140–143, etc.] and methods of protection from them [**33** 15], and the focal occurrence of transmissible diseases [**37** 18], a chapter on which has been added. Four new appendices contain, respectively, Pomerantzev's key to the Ixodids of the Soviet Union [**34** 209], and short reviews of measures against ticks, the ways in which DDT is used and Russian work on the development of new insecticides, chiefly of vegetable or coal-tar origin.

Roy (D. N.) & Ghosh (S. M.). **Phenyl Cellosolve in the Treatment of Pediculosis.**—*Indian med. Gaz.* **82** no. 4 pp. 199–200, 3 refs. Calcutta, 1947.

Tests in which the heads of 22 patients at an Indian hospital, including 20 women and girls with long hair, were treated by means of a pad of cotton-wool with a mixture of 5 per cent. by volume of phenyl cellosolve (ethylene glycol monophenyl ether), 37·5 per cent. absolute alcohol or isopropanol and 57·5 per cent. water for the control of heavy infestations of head lice [*Pediculus *humanus capitis*, Deg.] showed that 5 per cent. phenyl cellosolve is potent against the lice and their eggs [*cf. R.A.E.*, B **34** 1, etc.]. The treatment was effective, although some of the patients were allowed to wash their hair after two hours. One application of the mixture also destroyed all lice and eggs in a heavy infestation of *Phthirus pubis*, L., on the beard and the hairs of the axillae and pubic and perineal regions.

PAPERS NOTICED BY TITLE ONLY.

FLOCH (H.) & CHASSIGNET (R.). **Phlébotomes de la Guyane française (XIX). *P*[*hlebotomus*] *colas-belcouri* n. sp.**—*Publ. Inst. Pasteur Guyane* no. 152, 3 pp., 1 fig. Cayenne, 1947. **(XX).** *P. dendrophyllus* **Mangabeira, 1942 et** *P. quadrispinosus* **n. sp.**—*Op. cit.* no. 155, 5 pp., 2 figs., 1 ref. **(XXI).** *P. abonnenci* **n. sp.**—*Op. cit.* no. 157, 3 pp., 1 fig.

FLOCH (H.) & ABONNENC (E.). **Phlébotomes de la Guyane française (XXII). Clef d'identification de 144 phlébotomes mâles du nouveau continent.**—*Publ. Inst. Pasteur Guyane* no. 161, 17 pp., 2 refs. Cayenne, 1947.

CRISTOL (S. J.), SOLOWAY (S. B.) & HALLER (H. L.). **Isolation of the o,o′-DDT Isomer from technical DDT.**—*J. Amer. chem. Soc.* **69** pp. 510–515, 7 refs. Easton, Pa., 1947. [See *R.A.E.*, A **38** 402.]

CRISTOL (S. J.) & HALLER (H. L.). **The Isolation of 1,1-dichloro-2-*o*-chlorophenyl-2-*p*-chlorophenylethane from technical TDE [DDD].**—*J. Amer. chem. Soc.* **70** pp. 1323–1324. Easton, Pa., 1948. [See *R.A.E.*, A **38** 402.]

CARTER (R. H.). **Report on Methods for Determination of DDT in Insecticide Residues and in Animal Products.**—*J. Ass. off. agric. Chem.* **30** no. 3 pp. 456–463, 27 refs. Washington, D.C., 1947.

CARTER (R. H.). **Estimation of DDT in Milk by Determination of organic Chlorine.**—*Industr. Engng Chem.* Anal. Edn. **19** p. 54, 3 refs. Easton, Pa., 1947. [*Cf. R.A.E.*, A **38** 382.]

GOODHUE (L. D.) & HAZEN (A. C.). **Viscosity and Density of four Liquefied-gas Aerosol Solutions containing DDT.**—*Analyt. Chem.* **19** pp. 248–250, 2 figs., 4 refs. New York, N.Y., 1947. [See *R.A.E.*, A **38** 402.]

BOWEN (C. V.) & POGORELSKIN (M. A.). **Determination of the Gamma-isomer Content of Benzene Hexachloride.**—*Analyt. Chem.* **20** pp. 346–348, 1 graph, 8 refs. New York, N.Y., 1948. [See *R.A.E.*, A **38** 403.]

CUPPLES (H. L.). **Infrared Absorption Spectrum of Gamma-Benzene Hexachloride** [for quantitative determination].—*Analyt. Chem.* **21** p. 630, 1 fig., 2 refs. New York, N.Y., 1949. [See *R.A.E.*, A **38** 403.]

HOWARD (B. H.). **The Determination of small Amounts of Hexachlorocyclohexane (Benzene Hexachloride).**—*Analyst* **72** no. 859 pp. 427–431, 6 refs. London, 1947. [See *R.A.E.*, A **38** 403.]

BAKER (W. C.) & SCHWARTZ (L. G.). **Preliminary Studies on the Control of Blowflies with DDT.**—*Publ. Hlth Rep.* **62** no. 22 pp. 800–807, 1 pl., 1 ref. Washington, D.C., 1947.

Preliminary tests with DDT deposits for the control of Calliphorids were made in Georgia at a fish market, an abattoir, a hide-processing establishment and a plant for the processing of shell-fish and other sea food, using 5 per cent. DDT in xylene emulsion at 200 and 300 mg. DDT per sq. ft. Populations were sampled by the grill method [*R.A.E.*, B **38** 158], which was superior to any other tried, although blowflies do not rest on the grill as long as house-flies [*Musca domestica*, L.]. Only Calliphorids were counted, and the predominant genera were *Callitroga* (*Cochliomyia*) and *Lucilia*. Calliphorids tend to use scattered night resting places, mostly on vegetation, and seldom enter buildings. They can fly great distances, prefer putrefying food and tend not to alight elsewhere.

The success of the measure depended largely on whether the vegetation on which the flies rested at night was sprayed. Where only the area about the daytime feeding places was treated, control lasted for 2–3 weeks, but at establishments where the night resting places also were sprayed, control remained effective for periods of up to three months.

FAY (R. W.), COLE (E. L.) & SIMMONS (S. W.). **Toxicity of DDT Residues. Effect of Surface and surface Treatment on the residual Toxicity of DDT against adult *Anopheles quadrimaculatus* Mosquitoes.**—*Soap & sanit. Chem.* **24** no. 6 pp. 130–133, 157, 159, 189, 3 graphs, 3 refs. New York, N.Y., 1948.

The laboratory investigations described were carried out to extend previous work on the relative effectiveness of deposits of DDT from xylene emulsions on specified surfaces [*R.A.E.*, B **37** 238] and to study the comparative effectiveness of deposits from emulsions, solutions and suspensions on specified surfaces and the effect of cleaning operations on the duration of toxicity. Adults of *Anopheles quadrimaculatus*, Say, were exposed for an hour in boxes with the sides formed of panels of various materials [**37** 237] that had been sprayed to give deposits of 200 mg. DDT per sq. ft., and the mortality of the females was recorded after 24 hours.

The following is based on the authors' summary of the results. DDT deposits from a 5 per cent. emulsified xylene solution gave satisfactory results for six months on dry bamboo, bark, rusty metal screen, pine plywood and rusty sheet metal, but for only 1–2 months on new sheet metal, glass, tile, palmetto thatch and new metal screen. Mortality was unsatisfactory on plexiglass, shellac-treated wood, cement, waxed wood and waxed linoleum.

The relative effectiveness of DDT deposits from unemulsified kerosene solutions on different surfaces followed the same general pattern as that of the deposits from xylene emulsion, but the solutions were somewhat less effective than the emulsions. Deposits from suspensions of water-wettable DDT were better than deposits from the emulsion on the absorbent surface of cement, and somewhat better on the smooth surfaces of glass, new sheet metal and tile. They were inferior on plywood, palmetto thatch and bamboo, and showed very little lasting toxicity on simulated adobe [*cf.* **37** 238], although the deposit appeared to be adequate.

Dry-cleaning of textile fabrics rapidly reduced the effectiveness of a deposit of DDT, but washing with soap and water had little immediate effect. The use of a hot iron rapidly reduced effectiveness. The initial treatment with a vacuum cleaner had more effect than subsequent ones, but vigorous brushing apparently removed more DDT with each brushing. Removal of dust with a cloth caused only a gradual decrease in effectiveness. Wax applied to surfaces previously treated with DDT covered the deposits to a great extent.

Beacher (J. H.) & Parker (W. L.). **Residual Toxicity. Chlorinated Camphene compared to DDT for toxic residual Effects on various Surfaces and in Paints against the House Fly.**—*Soap & sanit. Chem.* **24** no. 6 pp. 139, 141, 143, 163, 1 ref. New York, N.Y., 1948.

The following is mainly from the authors' summary. Various surfaces, including pebbled glass, unpainted wood, Celotex, Texolite water paint, whitewash plus toxicant and whitewash on which the toxicant was sprayed after drying, were treated with comparable water emulsions containing 10 per cent. by weight of toxaphene or DDT to give a theoretical deposit of 100 mg. toxicant per sq. ft., made to form four sides of cubical cages, and compared for lasting effectiveness against *Musca domestica*, L., over a period of 225 days. Each insecticide gave complete mortality on all surfaces throughout the test with 24 hours' exposure. DDT proved superior to toxaphene in speed of knockdown and in mortality after six hours' exposure for all surfaces tested. The effect of ageing on the knockdown resulting from exposure to deposits of both insecticides varied considerably throughout the observations. In the case of toxaphene, the time required for complete knockdown increased on pebbled glass and Celotex surfaces and decreased on unpainted wood, water paint, and both whitewashed surfaces, whereas with DDT, it remained constant on unpainted wood, water paint and Celotex, but increased on pebbled glass and both whitewashed surfaces. Six-hour mortality percentages with toxaphene were greatest on Celotex, followed by both whitewashed surfaces, pebbled glass, Texolite water paint and unpainted wood, in that order, and with DDT they were greatest on the two whitewashed surfaces, followed by Celotex, Texolite water paint, pebbled glass and unpainted wood. No significant difference was established between the knockdown or mortality rates for the two whitewashed surfaces.

Three series of pine panels, coated with treated paints into which 5 per cent. toxaphene or DDT had been incorporated immediately, one week or one month previously were observed for knockdown of *M. domestica* over a period of eight months. Toxaphene produced a greater knockdown than DDT with an oleoresinous enamel, oleoresinous flat wall paint and gloss water paint. DDT produced a greater knockdown with protein non-washable water paint and washable flat wall paint. Protein non-washable water paint and washable flat wall paint, with both toxicants, were more effective in initiation and completion of knockdown than all other paints. Toxicants in freshly mixed paint were more effective than those in paints aged before application with oleoresinous enamel, oleoresinous flat wall paint and gloss water paint. Toxicants in aged paints were superior in washable flat wall paint. Knockdown with protein non-washable water paint was equal in all series. Ageing of the film did not cause a significant reduction in knockdown throughout the entire observation period of the 225 days. Floor wax containing 5 per cent. DDT did not effect any knockdown within 48 hours.

Gersdorff (W. A.) & Schechter (M. S.). **Space Spray Toxicity. Toxicity to House Flies of Space Sprays containing certain Diaryl Ethers and Pyrethrum Extract.**—*Soap & sanit. Chem.* **24** no. 6 pp. 155, 157, 5 refs. New York, N.Y., 1948.

Preliminary tests have shown that certain substituted diaryl ethers have some toxicity to *Musca domestica*, L., and exhibit synergistic activity with pyrethrum extract. In further experiments, phenyl ether and seven substituted diphenyl ethers were dissolved in refined kerosene and tested by the turntable method [*cf.* *R.A.E.*, B **26** 246] in sprays alone or with 0·5 mg. total pyrethrins per ml. and in comparison with sprays of 0·5, 1 or 2 mg. pyrethrins per ml. These three pyrethrum sprays gave 21, 45 and 73 per cent. mortality in one day, respectively. At 100 mg. per ml., bis (p-bromophenyl) ether gave 98 and 99 per cent. kill alone and with pyrethrins, and p-bromophenyl phenyl ether gave 97 per cent. kill with or without pyrethrins. At 50 mg. per ml., the strongest synergistic action was shown by x-dichlordiphenyl ether, x-trichlordiphenyl ether and bis (p-bromophenyl) ether. In tests to determine the concentrations of the seven substituted compounds that would give 50 per cent. kill of *M. domestica* in combination with 0·5 mg. pyrethrins, these three compounds were significantly better than the others but did not differ significantly among themselves. Mixed with the 0·5 per cent. pyrethrins, 13 mg. per ml. of each had an effect about equivalent to the addition of 0·7 mg. pyrethrins. Each ether, when mixed at 40 mg. per ml. with the pyrethrins, formed a spray that caused a higher mortality than did one containing 2 mg. pyrethrins alone. The knockdown in 25 minutes was complete in all tests with the mixed sprays.

CALDWELL jr. (A. H.). **Small Spray Chamber II. Additional Notes on the Operation of the Hoskins Caldwell Spray Chamber.**—*Soap & sanit. Chem.* **24** no. 8 p. 133, 1 fig., 1 ref. New York, N.Y., 1948.

Modifications designed to improve the operation of Hoskins & Caldwell's small spray chamber for testing contact insecticides against *Musca domestica*, L. [*R.A.E.*, B **37** 201] are described. The slightly sloping cylinder has a hole in the bottom near the lower end from which a 6×6×46 in. vertical duct with the fly cage in its upper part leads down into a large flat box with a small opening, in which settling vapours are trapped. The duct greatly improved the down draught, resulting in a more uniform deposit. As the action depends on absolutely still air surrounding the apparatus, the latter is enclosed in a case measuring 30×48×90 ins., in which the temperature is maintained at 70–82°F. by a lamp in the upper part. It is essential for operation that the top part of the case should be warmer than the lower.

BLICKLE (R. L.), CAPELLE (A.) & MORSE (W. J.). **Insecticide resistant Houseflies.**—*Soap & sanit. Chem.* **24** no. 8 pp. 139, 141, 149, 3 graphs, 5 refs. New York, N.Y., 1948.

Fly-spray tests have been carried out in the laboratory of the New Hampshire experiment station for six years, during the last three of which the concentrations of various insecticides necessary to give 50 per cent. mortality of houseflies [*Musca domestica*, L.] have increased many times [*cf.* *R.A.E.*, B **38** 158, etc.]. The need for higher dosages began when the laboratory became contaminated with BHC (benzene hexachloride). The house-fly culture was reduced to a few individuals, and the subsequently used culture was bred from the survivors. As it was maintained in the same laboratory, all adult flies have since been continuously exposed to BHC. Recently, when flies were allowed to emerge from puparia from an uncontaminated source under the same conditions as the laboratory culture, less than 5 per cent. survived more than 24 hours. Flies emerging in an uncontaminated room from puparia of the same batch survived normally. Fly-spray tests made over a period estimated to cover 28 generations of the contaminated strain (one generation lasting 18 days) showed that whereas 0·01 per cent. γ BHC gave 40 per cent. mortality in the first generation, 0·03 per cent. was needed to give 34 per cent. kill of the

20th generation, and this concentration had practically no effect on the 28th. Comparative tests showed that about six times as much γ BHC and about twice as much of a thiocyanate (Lethane 384 Special [**33** 22]) was needed to give 50 per cent. mortality in January 1948 as in mid-summer 1946. A comparison of the resistance of flies from the contaminated area and an uncontaminated one to BHC, DDT, the thiocyanate and pyrethrins showed that flies from the contaminated source were more resistant in each case, the resistance to BHC being greater than that to the other insecticides.

TANADA (Y.), HOLDAWAY (F. G.) & QUISENBERRY (J. H.). **DDT to control Flies breeding in Poultry Manure.**—*J. econ. Ent.* **43** no. 1 pp. 30–36, 16 refs. Menasha, Wis., 1950.

The effectiveness of DDT for the control of flies breeding in the poultry manure that accumulates on the dropping boards of laying batteries was investigated in Hawaii between January and August 1950. The literature on the toxicity of DDT to fly larvae is briefly reviewed. At least 24 species of flies, ten of them of possible economic importance, nine species of beetles (mostly scavengers and predators), six species of parasitic Hymenoptera and one moth were reared from the droppings. *Musca domestica*, L., predominated, while some of the other flies were not present in sufficient numbers for study. DDT was most effective against the fly larvae when used in an emulsion. This was prepared from a 4·5 per cent. stock solution of DDT in petroleum base containing an emulsifying agent. A water suspension made from a 50 per cent. water-dispersible powder was about one-fourth as effective as the emulsified solution, and a dust was unsatisfactory even when it contained 10 per cent. DDT.

Sprays were applied to manure that had accumulated on the boards for four days, and three days later the manure was scraped from the boards and a weighed sample placed over sand in a box in a screened insectary for observation of pupation and emergence. An emulsion containing 0·125 per cent. DDT, applied at 43·3 cc. per sq. ft. (about 9 U.S. pints per 100 sq. ft.), gave complete control of breeding by *M. domestica*, *Fannia pusio*, Wied., *Chrysomyia megacephala*, F., and *Ophyra chalcogaster*, Wied., and one containing 0·25 per cent. at 21·7 cc. per sq. ft. was as good against *M. domestica* and *O. chalcogaster* and practically as good against *F. pusio* in a test in which *C. megacephala* was not present. The action appeared to be against the larvae and possibly against the pupae [*cf. R.A.E.*, B **35** 26–27]. A few adults of the Syrphid, *Volucella obesa*, F., and the Stratiomyiid, *Hermetia illucens*, L., emerged from manure treated with as much as 0·5 per cent. DDT in emulsified solution at 43·3 cc. per sq. ft. or 1 per cent. at 21·7 cc. per sq. ft. The addition of lime to the droppings, in accordance with normal practice to reduce odour and moisture, made them unsuitable for the breeding of these two species and caused little if any reduction in the toxicity of DDT to *M. domestica*, *F. pusio* and *O. chalcogaster*. Several Hymenopterous parasites emerged from fly puparia in manure treated with DDT at a concentration as high as 1 per cent. and also from puparia in manure containing lime.

HORSFALL (W. R.). **Influence of Environment on the Distribution of thermal Aerosols toxic to Mosquitoes.**—*J. econ. Ent.* **43** no. 1 pp. 37–40, 2 refs. Menasha, Wis., 1950.

Routine applications of insecticidal aerosols in the open have given erratic results against mosquitos in suburban areas because of variation in the habits of the mosquitos and also in distribution of the toxicant. A uniformly distributed, drifting fog is needed to kill inactive mosquitos, and most have only a short period of flight during the night. Distribution depends mainly on atmospheric conditions and the nature of the terrain. Some causes for indifferent abatement of mosquitos with aerosols were determined during the summer of 1949 in the suburban area west of Chicago where several thousands of pounds of DDT dissolved in oil were released as thermal aerosols over some 30 sq. miles for the control of *Aëdes vexans*, Mg., which migrates into the area during the summer. Solutions of 5 per cent. DDT in No. 3 diesel oil were applied at night from a Todd Insecticide Fog Applicator [*R.A.E.*, B **35** 128] mounted on a truck moving at 4–5 miles per hour on a line perpendicular to the line of drift of the fog. Some observations were also made with a stationary generator and one moving at other speeds. Mosquitos used in all experiments were reared females of *Culex pipiens*, L., and *C. restuans*, Theo., exposed in screen cylinders. During the routine work the cylinders were placed about 350 ft. away from the line of advance of the machine, and the mean percentages of mosquitos killed in different areas and on different nights varied from 10 to 61. Each mean was determined from 3–10 exposures. Mortality was high in areas where the aerosol drifted so that droplets seemed to move horizontally across a beam of light. Aerosol drifting over an area free of obstruction from a stationary generator dispersing it at 4 U.S. quarts per minute killed 95 per cent. of caged mosquitos 200 ft. away with exposure for 5 seconds and all with exposure for 15 seconds. A moving generator, when assisted by a slight cross wind, dispersed an aerosol more uniformly with successive trips past the test area. Varying the speed of movement of the generator between 5 and 15 miles per hour did not affect uniformity of dispersal. In a calm atmosphere, aerosols containing smaller droplets were more effective than those containing larger ones at a distance of 150 ft. from the generator. Mists containing larger droplets were much more effective when borne by winds with velocities of three miles per hour near the ground than when borne by winds with velocities of only 0·7 mile per hour, twice to three times the number of trips being needed with the lower velocity to achieve the same result. Aerosols were irregularly distributed over terrain broken by obstructions such as a low grass barrier, and mortality of caged mosquitos was lower when the cages were inside a narrow barrier than when they were behind it.

GRANETT (P.) & FRENCH (C. F.). **Field Tests of Clothing treated to repel American Dog Ticks.**—*J. econ. Ent.* **43** no. 1 pp. 41–44, 5 refs. Menasha, Wis., 1950.

An account is given of field tests against *Dermacentor variabilis*, Say, in New York of tick repellents that had shown promise when tested by a laboratory method [*R.A.E.*, B **36** 164] against *Amblyomma americanum*, L. Impregnation of clothing with the repellents rather than direct application to the skin seemed to be desirable as ticks generally crawl from vegetation to clothing. For preliminary trials, the detached lower portions of cotton trouser legs (from the knee down) were used. They were impregnated with an acetone solution of a repellent and worn in infested areas, where the wearers compared the number of ticks crawling on an impregnated trouser leg with the number on an untreated one (or one treated with another substance) worn at the same time. The bottom of the trouser leg was fastened with a rubber band round the ankle. Several hundred ticks could be picked up on untreated clothing in 5–10 minutes. The results obtained with 11 chemicals used to impregnate trouser legs at 2 or 4 gm. per sq. ft. three days or three weeks earlier are shown in a table. There was a definite gradient in effectiveness, indicating that the method was useful as a rapid intermediate step between laboratory and extensive field trials. It appeared to be more reliable than the use of treated drag cloths. Dibutyl adipate and n-hexyl mandelate [*cf.* **38** 102, 152] were outstanding among the

11 materials, and were the only ones that gave 90 per cent. protection or over at both rates of application and both ages. Dimethyl phthalate and Indalone (n-butyl mesityl oxide oxalate) gave only moderate protection [*cf.* **35** 190; **38** 152]. In practical tests of dibutyl adipate and n-hexyl mandelate on overalls and trousers, impregnation at 2 gm. per sq. ft., either from solutions in a highly volatile solvent such as acetone or from water emulsion, gave a high degree of protection (about 90 per cent. or over) when tested over periods of 2–4 hours, even when clothing had been impregnated two weeks before the test. Treatment with 1 gm. per sq. ft. was also satisfactory in the case of n-hexyl mandelate, but less so in that of dibutyl adipate. Limited information on toxicology indicated that both materials are safe for use on outer clothing at 2–4 gm. per sq. ft.

Sun (Yun-pei). **Toxicity Index—an improved Method of comparing the relative Toxicity of Insecticides.**—*J. econ. Ent.* **43** no. 1 pp. 45–53, 12 refs. Menasha, Wis., 1950.

The author considers that the toxicity of an insecticide is best expressed by comparing it with some standard insecticide against a given species of insect and calculating a toxicity index according to the formula 100 S/T, where S and T are the median lethal doses (expressed as median lethal concentrations in this paper) of the standard and the test insecticide, respectively. In experiments demonstrating the use and validity of this index, adults of *Musca domestica*, L., were sprayed with various organic insecticides by the wind-tunnel technique in an apparatus in which the gradually contracting spraying tunnel [*cf. R.A.E.*, B **38** 148] was replaced by one of a uniform diameter of 4 ins., to facilitate the measurement of wind speed. Insecticide solutions were made with No. 10 oil, and in standard tests, a constant volume of 0·6 ml. was sprayed at a pressure of 6 lb. per sq. in. and passed through the tunnel at ten miles per hour. At least three concentrations of the test solution and four of the standard, giving mortalities of 30–80 per cent., were used, and mortality counts were made after 18–20 hours. The temperature was 80°F., and the relative humidity 40–50 per cent.

The index varies with species of insect, method of application and temperature, but the differences can be minimised by the use of a standard that is similar in composition to the test insecticide. In experiments described, in which the flies were exposed to pairs of insecticides of similar composition, it was not much affected by volume of spray, wind velocity in the tunnel, fineness of spray, spraying pressure, the criterion of death, the length of time between spraying and mortality counts, the age and size of the flies and the mortality of untreated flies. It is shown that the toxicity index of one insecticide with respect to another can be transformed by a simple calculation to an index based on another standard with very little error, and it is suggested that strains of insects can be characterised by their toxicity indices to a number of insecticides.

In tests in which the flies were exposed to more than pairs of insecticides, the materials used, in order of decreasing toxicity indices, were dieldrin (1,2,3,4,10,10-hexachlor-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-di[endo]-methanonaphthalene, melting point 175–176°C.), γ benzene hexachloride (m.p. about 110°C.), aldrin (1,2,3,4,10,10-hexachlor-1,4,4a,5,8,8a-hexahydro-1,4,5,8-di[endo]methanonaphthalene, m.p. 103–104°C.), β chlordan (m.p. 103·5–105°C.), rotenone (pure), a sample of redistilled technical chlordan, p,p′DDT (aerosol grade, setting point 104°C.), pyrethrins (as a 20 per cent. extract), α chlordan (m.p. 101–102·5°C.), and technical toxaphene.

McBride (O. C.), Sullivan (W. N.) & Fulton (R. A.). **Treatment of Airplanes to prevent the Transportation of Insects.**—*J. econ. Ent.* **43** no. 1 pp. 66–70, 3 graphs, 6 refs. Menasha, Wis., 1950.

Investigations on the effectiveness of insecticide deposits and aerosols, alone and in combination, for the control of insects being accidentally transported in aircraft are described. Most of the numerous insects used were agricultural pests, and the methods and results of the tests are therefore noticed in more detail elsewhere [*R.A.E.*, A **38** 429]. *Musca domestica*, L., and mosquitos (*Anopheles quadrimaculatus*, Say, and *Aëdes aegypti*, L.) proved very susceptible to the treatments tested. A mixture of DDT, dichlordifluoromethane, piperonyl butoxide, pyrethrum extract (20 per cent. pyrethrins) and methylene chloride (10 : 20 : 5 : 5 : 60) propelled by carbon dioxide was the best of 17 mixtures used, and one of DDT, cyclohexanone, dichlordifluoromethane, piperonyl butoxide, pyrethrum extract and lubricating oil (3 : 5 : 84 : 2 : 5 : 1) the most satisfactory of 24 aerosols. In aeroplanes, the best results were obtained with a combination of deposit and aerosol treatment. A high mortality of agricultural insects, cockroaches (*Periplaneta americana*, L.), house-flies and mosquitos was obtained with a deposit of 150 mg. DDT per sq. ft. together with 20 gm. aerosol per 1,000 cu. ft.

Pimentel (D.) & Dewey (J. E.). **Laboratory Tests with House Flies and House Fly Larvae resistant to DDT.**—*J. econ. Ent.* **43** no. 1 p. 105. Menasha, Wis., 1950.

The development of resistance to DDT by *Musca domestica*, L., has been recorded by several workers [*cf.* *R.A.E.*, B **38** 158]. The observation of resistant strains in the field in New York [*cf.* **38** 87, 134] led to laboratory studies in the autumn of 1948 in which some 44,000 flies, belonging either to a field strain or a strain that had been reared in the laboratory for several generations, were exposed to deposits of seven insecticides. These, in order of decreasing effectiveness to the non-resistant flies of the laboratory strain, were dieldrin [1,2,3,4,10,10 - hexachlor - 6,7 - epoxy - 1,4,4a,5,6,7,8,8a - octahydro - 1,4,5,8-diendomethanonaphthalene], γ BHC (benzene hexachloride), aldrin [1,2,3,4,10,-10 - hexachlor - 1,4,4a,5,8,8a - hexahydro - 1,4,5,8 - diendomethanonaphthalene], DDT, chlordan, methoxy-DDT (methoxychlor) and emulsifiable pyrenone [pyrethrum extract with a synergist]. The first three were effective at much lower concentrations than the others. The field flies were about seven times as resistant to DDT as the laboratory flies on the basis of the median lethal dose. They showed a possible slight resistance to methoxy-DDT but no detectable resistance to the other five materials. A culture of the same field strain lost resistance to DDT when the flies were not exposed for ten generations.

The reactions of larvae of the two strains to DDT were then compared. A solution of 10 mg. technical DDT in 40 ml. acetone was incorporated into 37·5 gm. of a mixture of 8 parts wheat bran and 5 parts rolled oats, and when the acetone had evaporated, 1 gm. yeast, 1 gm. malt and 60·5 ml. water were added. The larvae were placed in this medium when three days old, and the mortality after 72 hours was 84 per cent. for the laboratory strain and 46 per cent. for the field strain, the difference being statistically significant.

Beck (S. D.). **The Toxicology of Antimycin A.**—*J. econ. Ent.* **43** no. 1 pp. 105–107, 1 graph, 7 refs. Menasha, Wis., 1950.

The author states that unpublished experiments by Kido have shown that antimycin A, a recently discovered and isolated antibiotic, has insecticidal possibilities for at least a few species of insects and mites. In the experiments here described, it had no observable effect on cockroaches when ingested with food, but was very toxic when injected into the body cavity as a maize-oil solution or an emulsion in saline. Injection resulted in a depression of oxygen consumption, cardiac failure, sluggishness and death. The symptoms were consistent with the hypothesis that antimycin A inhibits the succinoxidase system or some other essential step in the oxidative metabolic cycle.

Burgess (R. W.). **Colonization of *Anopheles albimanus* from the Florida Keys.**—*J. econ. Ent.* **43** no. 1 p. 108, 2 refs. Menasha, Wis., 1950.

D. C. Thurman jr., in a personal communication, reported the finding of *Anopheles albimanus*, Wied., considered to be the most important vector of malaria in the Caribbean Region, in significant numbers in the Florida Keys. To determine the comparative susceptibility of this Florida strain of *A. albimanus* to various strains of malaria and to make ecological studies, a colony (designated the A-3 strain) was established in a laboratory in South Carolina in 1948 and ultimately yielded 10,000 pupae per month. In December 1948 a sub-colony was established at a laboratory in Georgia. A sub-colony of the colony of *A. albimanus* established in Panama by Rozeboom [*R.A.E.*, B **24** 268] is being maintained in South Carolina for comparison and has been designated the A-2 strain.

Cuff (R. L.). **Fused Bentonite Sulphur to prolong Horn Fly Protection on Beef Cattle.**—*J. econ. Ent.* **43** no. 1 pp. 111–112. Menasha, Wis., 1950.

In tests carried out in 1949 to find ways of prolonging the protection afforded by insecticides against horn flies [*Siphona irritans*, L.] on beef cattle, so as to reduce the number of applications necessary during the season, the addition of 0·12 per cent. fused bentonite sulphur to the sprays was effective. It increased by 41·4, 33·1 and 86·7 per cent., respectively, the periods of protection given by a 0·5 per cent. suspension of methoxy-DDT (methoxychlor), a spray of 0·025 per cent. lindane [at least 99 per cent. benzene hexachloride] as an emulsified solution, and a 5 per cent. emulsion of pyrenone (a concentrate containing 1 per cent. pyrethrins and 10 per cent. piperonyl butoxide [*cf. R.A.E.*, B **37** 161]).

In one test in Oklahoma, 44 Hereford bulls heavily attacked by *Tabanus*, principally *T. sulcifrons*, Macq., were protected for 14 days by spraying with a mixture of 1 : 10 pyrenone emulsion and 0·72 per cent. fused bentonite sulphur. A lot of 129 steers on pasture, with an initial average of 500 horn flies, was sprayed on 17th June with a mixture of 0·625 per cent. DDT, 0·625 per cent. methoxy-DDT and 0·25 per cent. fused bentonite sulphur and did not have to be sprayed again before being sold on 13th September. Spraying 17 bulls on pasture with a mixture of 0·25 per cent. DDT, 0·025 per cent. lindane and 0·12 per cent. fused bentonite sulphur kept the average number of horn flies per animal, which had originally been 150, below 25 for 72 days. These lots were well isolated from other cattle.

Hansen (J. W.). **Oil Concentration in dilute Emulsions.**—*J. econ. Ent.* **43** no. 1 pp. 112–113. Menasha, Wis., 1950.

Work in connection with the use of oils for the control of weeds in irrigation ditches, has shown that the concentration of oil in a 100-ml. sample of the ditch water can be roughly but adequately measured by adding about 5 ml. of a red dye that is soluble in the oil and not in the water, shaking vigorously and comparing the sample with similarly prepared standards. In all probability, the test can be extended to ascertain the concentration of oil in water to which it has been added for other purposes [*cf. R.A.E.*, B **38** 167]. The sample shows an intensity of colour directly proportional to the concentration of oil if this is between 100 and 500 parts per million ; if the concentration is over 500 p.p.m., the sample is diluted with water to bring it within measurable range.

HILL (E. L.) & INGRAHAM II (S. C.). **A Study of Murine Typhus Fever in Coffee County, Alabama.**—*Publ. Hlth Rep.* **62** no. 24 pp. 875–881, 2 refs. Washington, D. C., 1947.

Cases of murine typhus in man were diagnosed in the United States in 1913 and have been reported in considerable and increasing numbers since 1926 [*cf. R.A.E.*, B **37** 224]. In November 1943, a study of a typical area was begun, with a view to determining the practicability of controlling the disease under rural conditions. Coffee County, Alabama, was chosen because of its consistently high reported typhus rate over several years and its rural character. Case records and serological tests indicated a morbidity rate of 500 per 100,000 population in 1943. Incidence was higher among those over 30 years old than those under 30 and among men than women, probably because of occupational exposure. It was highest in July and October. This may be associated with harvesting of summer grain crops and autumn thrashing of groundnuts, both dusty occupations carried out in places usually heavily infested with rats.

Serological tests indicated that the disease is widespread in *Mus* (*Rattus*) *rattus* and *M.* (*R.*) *norvegicus*, which occurred in about equal numbers in the county. Over half the farms examined yielded rats giving positive reactions, though usually only one or two rats were examined from each farm. The ectoparasites collected on rats in significant numbers were *Xenopsylla cheopis*, Roths., *Echidnophaga gallinacea*, Westw., *Leptopsylla segnis*, Schönh., *Echinolaelaps echidninus*, Berl., *Liponyssus bacoti*, Hirst, and *Polyplax spinulosa*, Burm. Typhus infection in rats as indicated by the complement-fixation test appeared to be directly related to infestation with *X. cheopis*.

HOLLENBECK (A. H.). **A practical Method for Mass Production and Transfer of *Xenopsylla cheopis*.**—*J. Parasit.* **32** no. 5 pp. 463–464, 1 fig. Lancaster, Pa., 1946.

To obtain large numbers of *Xenopsylla cheopis*, Roths., for experimental purposes in Texas, 3 ins. coarse wood shavings were placed in the bottom of a glass animal jar 9 ins. high and on them a white mouse infested with about 40 fleas. The jar was fitted with a screen lid covered with muslin and left undisturbed at room temperature for about a month, during which time the mouse was fed daily on "rat checkers" and water-soaked carrots. Mice were more suitable than rats as the quantity of urine excreted was much less. The flea larvae fed on the mouse faeces and other débris and pupated in the bedding. Uneaten carrots and checkers were removed to prevent the growth of mould.

When the adult fleas of the new generation began to emerge, the mouse was transferred to another jar and a new colony started. The infested bedding from the old jar was poured through a large funnel into a U.S. gallon glass jar with a standard screw-top cover. A round piece of wire screen was placed over the bedding in the new jar and fastened to the sides with adhesive tape. This allowed the fleas to crawl through, but prevented the bedding from falling out when the jar was inverted. When enough fleas for use had emerged, a U.S. quart fruit jar was fastened to the mouth of the larger jar and the whole inverted. The fleas were thus transferred to the smaller jar and from it they were again transferred to test-tubes or other suitable containers through a glass funnel. Fleas continued to emerge from the débris for about a month. Under optimum conditions, more than 1,500 fleas were obtained from one jar.

COOPER (K. W.). **The Occurrence of the Mite** *Cheyletiella parasitivorax* **(Mégnin) in North America, with Notes on its Synonymy and "parasitic" Habit.**—*J. Parasit.* **32** no. 5 pp. 480–482, 11 refs. Lancaster, Pa., 1946.

Eleven records are given of the occurrence of *Cheyletiella parasitivorax*, Mégn., in America between 1919 and 1944 (on cats, rabbits and fleas in the United States, a domestic rabbit in the Panama Canal Zone and a hare in Canada). One of the records concerns infestation of a domestic rabbit in California in 1942 by mites that were described as *Ewingella americana*, gen. et sp. n., by Vail & Augustson [*R.A.E.*, B **32** 138]. The author concludes from the examination of a paratype that *E. americana* is a synonym of *C. parasitivorax* and states that E. W. Baker supports this view. Neither of the two cats on which *C. parasitivorax* has been found in recent years showed signs of injury by it, and although no mites of other species were found on them, the author is of the opinion that *C. parasitivorax* probably preys on soft-bodied mites parasitising the mammalian host, and that no available evidence that it attacks mammals [*cf. loc. cit.*] is conclusive. He attributes its presence on the cats to the clearing up of an infestation of another species or to recent transfer of the mites from another animal, such as a rabbit.

TREMBLEY (H. L.). *Aëdes atropalpus* **(Coq.) a new Mosquito Vector of** *Plasmodium gallinaceum* **Brumpt.**—*J. Parasit.* **32** no. 5 pp. 499–501, 11 refs. Lancaster, Pa., 1946.

Plasmodium gallinaceum has been shown to develop in 28 species of mosquitos, including ten that occur in North America [*R.A.E.*, B **34** 65], but not all have been proved capable of transmitting it. In 1941, *Aëdes atropalpus*, Coq., was shown to be susceptible to *P. lophurae*, but failed to transmit it to ducks [**30** 95]. In this paper, an account is given of experiments in which *A. atropalpus* was infected with *P. gallinaceum* and transmitted it to chicks by biting. The author has found that *A. atropalpus* can lay viable eggs without a blood-meal, and, probably for this reason, many of the females of a batch in a cage do not seek blood when it is offered. To obviate the need for exposing a chick to several hundred in order to induce 30–40 to feed, a hand was placed in the cage to attract the hungry females. When they alighted, they were immediately transferred to individual containers. About half of these females fed promptly when offered a blood-meal. In five comparative tests with this species and *A. aegypti*, L., one of the previously known vectors, the percentage of females becoming infected and the oöcyst rate were both higher in *A. atropalpus*.

PHILIP (C. B.) & WOODWARD (T. E.). **Tsutsugamushi Disease (Scrub or Mite-borne Typhus) in the Philippine Islands during American Reoccupation in 1944-45. II. Observations on Trombiculid Mites.**—*J. Parasit.* **32** no. 5 pp. 502–513, 6 figs., 21 refs. Lancaster, Pa., 1946.

Records are given of 11 species of Trombiculid larvae taken in various parts of the Philippine Islands during surveys in connection with the occurrence of tsutsugamushi disease among United States troops in 1944–45 [*cf. R.A.E.*, B **37** 148]. Two (one of them undescribed) were on lizards and the other nine (not ten as stated previously [**37** 149]) on field rats. The mites on lizards and five of those on rats were of the genus *Trombicula* (including *Eutrombicula*), the species on rats being *T. bodensis*, Gunther, *E.* (*T.*) *wichmanni*, Oudm., *T. acuscutellaris*, Walch, *T. akamushi*, Brumpt, and *T. deliensis*, Walch. The last two are proved vectors of the disease [**34** 147, etc.]. Comment is made on the variation in members of the *akamushi-deliensis* complex [*cf.* **20** 234] as found in different parts of the Philippines and elsewhere. It appears that in certain geographical areas, the populations of *akamushi* and *deliensis* are relatively constant and distinguishable, whereas in others the characters become mutable. Variations in the Philippine material could not be correlated with different types of environment. It is thought that these mites may belong to a complex of recent evolutionary origin. The correct name for the species referred to as *wichmanni* is also discussed [*cf.* **38** 161], and morphological data on the Philippine material are given. This mite was taken on man in northern Luzon [**37** 149] and as it is widely distributed in the Archipelago, it is considered to be a potential incidental vector of tsutsugamushi disease.

Other records of Trombiculids in the Philippines are briefly reviewed, and a key is given to the known Philippine species and some that have been found on neighbouring islands or might be introduced because they occur on migratory hosts. The use of treated clothing and the clearing of infested areas, adopted as precautions against mite-infestation during certain military operations, are briefly discussed.

Scott (J. A.). **Observations on the Rate of Growth and Maturity of *Litomosoides carinii*, a filarial Worm of the Cotton Rat.**—*J. Parasit.* **32** no. 6 pp. 570–573, 1 graph, 11 refs. Lancaster, Pa., 1946.

The following is virtually the author's summary. Uninfected cotton rats (*Sigmodon hispidus texianus*) were exposed for ten days to colonies of *Liponyssus bacoti*, Hirst, some of which were infected with *Litomosoides carinii* [*cf. R.A.E.*, B **37** 139, etc.]. On autopsy of the rats at various intervals thereafter, the largest worms of each sex were measured. On the basis of these and other observations, growth curves for the species were plotted. It is tentatively concluded that the average final length attained is about 20 mm. for males and 80 mm. for females. The maximum size is reached in some cases as early as 2½ months after infection. Microfilariae were found in the blood as early as 50 days after infection, when the females were half their ultimate size and the males had completed 85 per cent. of their growth.

Philip (C. B.). **Observations on Tsutsugamushi Disease (Mite-borne or Scrub Typhus) in northwest Honshu Island, Japan, in the Fall of 1945. I. Epidemiological and ecological Data.**—*Amer. J. Hyg.* **46** no. 1 pp. 45–59, 8 figs., 24 refs. Lancaster, Pa., 1947. **II. Systematic Comment on the Japanese Vole-mites.**—*T. c.* pp. 60–65, 20 refs.

In the first of these parts, the etiology of tsutsugamushi disease is discussed and an account is given of observations on the disease made in Niigata and Yamagata prefectures in north-western Honshu in October 1945. The only authenticated endemic areas then known in Japan were in these prefectures and in Akita, to the north of them. Foci of infection were limited to the immediate vicinity of rivers. There had been a steady decline in cases during the previous decade, not entirely attributable to reduced flooding of the rivers during the spring or to deficient reporting during the war years. However, mortality remained high. One case occurred in 1945 on an isolated branch of a river where infection had not previously been known. In complement-fixation tests using antigens prepared from a New Guinea and a Burmese strain of the disease, sera of three Japanese residents recovering from attacks in 1945 gave positive reactions with the former but no reaction with the latter, whereas sera of three recovered from attacks in 1944 gave higher titres with the latter than the former and a fourth the same titre with both. The author considers that *Rickettsia* (*Theileria*) *tsutsugamushi* is a valid name, earlier than *R. orientalis*, for the causal organism of the disease.

In Niigata prefecture, six species of Trombiculid larvae were found in mid-October on *Microtus montebelli*, a rodent found in abundance in all focal areas, and one in which natural infection is known to occur. The mites were *Trombicula akamushi*, Brumpt, *T. pallida*, Nagayo *et al.*, *T. palpalis*, Nagayo *et al.*, *T. japonica*, Tanaka *et al.*, *T. scutellaris*, Nagayo *et al.*, and an undescribed species of *Gahrliepia*. The first two were in considerable numbers. Reference to the literature and questioning of local residents did not indicate that any other native Murid was likely to be an important host of mites, but in Yamagata, a lactating female of *Apodemus speciosus*, was taken with all of the above species attached except *T. akamushi* and *T. scutellaris*. Examination of nests of suckling young of both rodents revealed no mites on the animals or free in the nest, though the mothers were heavily infested.

In the second part, the author discusses the characters and nomenclature of Trombiculids described in papers published, or in one instance privately circulated, by Japanese workers between 1909 and 1930, many of which are in Japanese, and gives a key to the species known from Japanese voles.

Davis (W. A.). **Typhus at Belsen. I. Control of the Typhus Epidemic.**—*Amer. J. Hyg.* **46** no. 1 pp. 66–83, 1 fig., 4 refs. Lancaster, Pa., 1947.

Details are given of the situation with regard to health and sanitation found in the concentration camp at Belsen, Germany, when it was taken over by British forces in April 1945. Typhus had been prevalent for four months, but the epidemic was rapidly controlled by dusting the inmates and their clothing and bunks and also corpses with DDT against body and head lice [*Pediculus humanus humanus*, L., and *P. h. capitis*, Deg.]. Almost all the inmates were heavily infested. A 5 per cent. DDT powder, which remained effective for about two weeks, was first used, but it was replaced by a 10 per cent. powder when supplies became available.

Davis (G. E.), Austrian (R. C.) & Bell (E. J.). **Observations on Tsutsugamushi Disease (Scrub Typhus) in Assam and Burma. The Recovery of Strains of** *Rickettsia orientalis*.—*Amer. J. Hyg.* **46** no. 2 pp. 268–286, 7 refs. Lancaster, Pa., 1947.

Further details are given on the recovery of numerous strains of *Rickettsia orientalis* in Assam and Burma, the main results of which have been noticed from a preliminary report [*R.A.E.*, B **37** 91–92]. In addition to man, it was isolated from rats and Trombiculid larvae on rats and musk shrews (*Suncus*) in Assam and from tree shrews (*Tupaia*) and Trombiculid larvae on rats and tree shrews in Burma. Accounts are also given of its isolation from laboratory rodents exposed to infestation by Trombiculids in nature. Reattachment experiments in Burma are described in which one strain of *R. orientalis* was recovered by keeping a piece of infested ear of a recently killed rat in a vial for 24 hours and then placing the mites that detached from it in the conchae of the ears of a white rat, and three strains by suturing infested portions of the ear of a native host to the conchae of white rats and removing the suture and portion of ear after 24 hours. Previous workers had failed to induce larvae to reattach to fresh hosts [**34** 147]. Should such reattachment occur in nature, certain methods of controlling rats would be potentially very dangerous. The presence of *R. orientalis* is better demonstrated in field surveys by testing batches of mites than by testing the tissue of mammalian hosts. This was confirmed by the results of paired tests with mites and the tissues of their hosts. In 121 experiments, involving the mites and tissues from 155 rats, *R. orientalis* was recovered from 18 lots of mites and from the tissues of only five rats. In only two experiments was it obtained from the tissues of a rat and from the mites infesting it. Having used gerbilles (*Gerbillus* spp.) extensively in Assam and Burma for demonstrating infection by inoculation, the authors conclude that these animals are better than white mice in providing material for the ready demonstration of rickettsiae, especially in primary isolations, although the gross findings at autopsy are comparable in the two animals.

Hammon (W. McD.) & Reeves (W. C.). **Interepidemic Studies on Arthropod-borne Virus Encephalitides and Poliomyelitis in Kern County, California, and the Yakima Valley, Washington, 1944.**—*Amer. J. Hyg.* **46** no. 3 pp. 326–335, 12 refs. Lancaster, Pa., 1947.

Results are given of studies on the Arthropod-borne virus encephalitis infections in Kern County, California [*R.A.E.*, B **36** 192] and the Yakima Valley, Washington [*cf.* **33** 80], made in 1944, an interepidemic year, and certain data obtained in epidemic years are quoted for comparison. All observations in Kern County for 1944 indicated very low infection rates with poliomyelitis and the western equine and St. Louis encephalitis viruses in man, and 18 cases of western equine encephalomyelitis in horses were reported as compared with 26 in 1943. No current infection with the new California virus [**36** 192] was demonstrated in man by serological tests. Rates of infection with the encephalitis viruses in mosquitos closely parallelled human rates. Only four strains were isolated from more than 14,000 Arthropods tested, whereas 32 and 33 strains were isolated in the epidemic years 1943 and 1945, respectively. The strains isolated in 1944 were one of the western equine virus and one (strain BFS-395) of the new California virus from 2,494 females of *Culex tarsalis*, Coq., and one of St. Louis virus and one of the California virus (BFS-283) from 4,425 females of *Aëdes dorsalis*, Mg. St. Louis virus had not previously been isolated from California or from a mosquito of the genus *Aëdes*. *A. dorsalis* was subsequently shown experimentally to be able to transmit it. Attempts to isolate encephalitis virus from hibernating females of *C. tarsalis* collected in Kern County during January 1945 were unsuccessful. Studies by means of precipitin tests of the feeding habits of *C. tarsalis*, *C. stigmatosoma*, Dyar, *C. thriambus*, Dyar, and *Aëdes dorsalis* taken from vegetation and shelters other than hen houses in Kern County showed that 92, 67·9, 78·1 and 10·5 per cent. of these species, respectively, had fed on avian blood and 0, 3·6, 0 and 73 per cent. on mammalian blood. Of 60 blood smears from the three species of *Culex* that reacted to avian antiserum, only seven reacted in more specific tests. One of 23 smears from *C. tarsalis* was positive with pigeon antiserum and three with antiserum with which blood from a number of wild birds reacted, and of 18 smears from *C. thriambus*, one was positive with turkey, one with duck and one with the wild-bird group antiserum. Of 71 smears from *A. dorsalis*, 18 were positive with horse, 38 with cow, 2 with sheep and 7 with fowl antiserum and six gave no specific reaction. Of domestic birds tested in January 1945, 19·2 per cent. had neutralising antibodies for the western equine virus and 35 per cent. for the St. Louis virus. Rates among fowls only were about the same. In a survey of wild rodents, one out of 42 had neutralising antibodies for St. Louis virus, none of 61 for western equine virus and nine out of 44 for the new California virus. No infection was found in ectoparasites of rodents.

In the Yakima Valley, no clinical cases of encephalitis in man were recognised in 1944, but seven strains of western equine virus and three of St. Louis virus were isolated from 1,967 females of *C. tarsalis*. The minimum infection rate (1 : 197) is slightly higher than those demonstrated during two previous epidemic years. No virus was isolated from 478 mosquitos of other species. Over 80,000 individuals of *Dermanyssus gallinae*, Deg. [*cf.* **33** 89, 178, etc.] collected in hen houses in the Yakima Valley were tested for virus, with negative results. In a small-scale survey of normal persons from the Yakima Valley, 29·3 per cent. of those examined had neutralising antibodies for western equine virus. This indicated a significant increase over the percentages for the epidemic years of 1940 and 1941.

To investigate the possibility of transovarian infection of mosquitos with the western equine and St. Louis viruses, 2,485 males of *C. tarsalis* collected in the field in the endemic areas in California and Washington and 1,018 field-collected males of *A. dorsalis* and 131 females of *C. tarsalis* reared from larvae from California were tested for virus, but all results were negative.

SABIN (A. B.), GINDER (D. R.) & MATUMOTO (M.). **Difference in Dissemination of the Virus of Japanese B Encephalitis among domestic Animals and Human Beings in Japan.**—*Amer. J. Hyg.* **46** no. 3 pp. 341–355, 17 refs. Lancaster, Pa., 1947.

A survey made during the summer of 1946 showed that the incidence of neutralising antibodies for the virus of Japanese B encephalitis in the endemic regions of Okayama and Tokyo was nil or insignificant in children and fowls but high in horses (84 per cent.), goats (70 per cent.), cattle (31 per cent.) and rabbits (33 per cent.) that had lived in these areas for various lengths of time during the preceding five non-epidemic years. The specificity of the antibodies was established, inasmuch as significant titres could not be demonstrated for the viruses of St. Louis or western equine encephalitis. It is thought justifiable to conclude that, during non-epidemic years in endemic areas, the virus of Japanese B encephalitis may be spread widely among horses and goats and to a smaller extent among cows and rabbits at a time when transmission to man and fowls occurs rarely or not at all.

Possible causes of such a difference in dissemination are discussed. The part played by mosquitos, and especially *Culex tritaeniorhynchus*, Giles, in spreading the virus during epidemics in Japan is generally regarded as important and established beyond reasonable doubt, but the mere presence of large numbers of these mosquitos and of susceptible human beings in an endemic area does not alone give rise to an epidemic. Studies made by M. Sasa during the late summer of 1946 in Okayama indicated that the mosquitos that are attracted to and bite horses, goats, cows and rabbits are, with minor variations in proportion, essentially the same. About 80 per cent. are *C. tritaeniorhynchus*, 10–20 per cent. *Anopheles hyrcanus* var. *sinensis*, Wied., and 0·4–3 per cent. *C. pipiens*, L. Fowls attracted almost equal numbers of *C. tritaeniorhynchus* and *C. pipiens*, but most of the biting was done by the latter. Of the mosquitos that bit man, 61 per cent. were *C. tritaeniorhynchus*, 16 per cent. *C. pipiens* and 13 per cent. *A. h. sinensis*. The assumption that, during non-epidemic periods, the total number of *C. tritaeniorhynchus* capable of transmitting the infection is very small and that *C. pipiens* may not be infected at all, so that only animals that attract large numbers of *C. tritaeniorhynchus* become infected while man and fowls do not, would not explain the high incidence of antibodies in goats, since in Sasa's experiments traps baited with goats attracted only twice as many mosquitos as traps baited with man, nor would it explain the relatively low incidence among cows in some districts. Furthermore, if inter-epidemic dissemination depended entirely on small numbers of *C. tritaeniorhynchus* capable of transmitting the virus, it would be expected to occur in Okayama between late July and mid-September, when these mosquitos are most prevalent. There is evidence from horses, however, that transmission is not associated with this period. It is therefore suggested that vectors other than mosquitos may disseminate the virus during the interepidemic periods. Three lots of *Dermanyssus gallinae*, Deg., from Japanese fowls tested during 1946 in Tokyo yielded negative results.

SABIN (A. B.), SCHLESINGER (R. W.), GINDER (D. R.) & MATUMOTO (M.). **Japanese B Encephalitis in American Soldiers in Korea.**—*Amer. J. Hyg.* **46** no. 3 pp. 356–375, 6 figs., 7 refs. Lancaster, Pa., 1947.

In August 1946, four cases of Japanese B encephalitis occurred among the 50,000 United States troops in Korea, including three among 1,500 men in an isolated camp. The course of the disease in each of the four cases is described, and accounts are given of laboratory investigations and serological tests on the one case that was fatal and specific diagnosis of the non-fatal cases by complement-fixation tests. The troops in the camp were exposed to attack by mosquitos, which were abundant, although the rice-fields within one mile of it were dusted with DDT. Insect repellents were not used until the cases of encephalitis appeared. Small numbers of mosquito larvae found in rice-fields and irrigation ditches on 31st August were identified as *Culex tritaeniorhynchus*, Giles, and *Anopheles hyrcanus* var. *sinensis*, Wied. *C. pipiens* var. *pallens*, Coq., *C. bitaeniorhynchus*, Giles, and *Aëdes togoi*, Theo., were reported in the area between 6th and 14th September. On the day after symptoms appeared in the third case, all United States troops at this camp were vaccinated against Japanese B encephalitis, and anti-mosquito measures were intensified. The effect of this procedure cannot be estimated, but two new cases of malaria occurred in the camp a fortnight after the last case of encephalitis. Vaccination was soon extended to all United States troops in Korea.

No cases of encephalitis in Koreans were found near the camp or reported anywhere in the American zone of occupation, and there are no records of epidemics in Korea, but evidence was later obtained that the incidence of inapparent infection with the virus of Japanese B encephalitis is even greater among the natives and their domestic animals than it is in Okayama, probably one of the most highly endemic areas of Japan.

HAZARD (F. O.). **Roach Powder Evaluation. A new Method for determining the Toxicity of insecticidal Powders to Roaches is discussed.**—*Soap & sanit. Chem.* **24** no. 9 pp. 125, 127, 4 figs., 4 refs. Baltimore, Md., 1948.

A description is given of apparatus and procedure used for testing insecticidal powders against cockroaches by blowing the powder downwards at a pressure of 8 lb. into a large bell jar with a false bottom of screen on which the cockroaches are exposed. The cockroaches thus receive a direct application of dust falling on their backs and rising from the glass base to their ventral surfaces. However, most of the material passes through the wire to the glass plate, and the cockroaches are never in contact with the deposit on the plate, though an appreciable amount of powder adheres to the screen. They are removed to clean dishes after 1–3 minutes and kept without food or water.

SWEETMAN (H. L.), CLARK (E. L.) & BOURNE (A. I.). **Smoke Dispensers for Insecticides.**—*Soap & sanit. Chem.* **24** no. 10 pp. 141, 143, 5 figs., 2 refs. Baltimore, Md., 1948.

The authors describe tests with canisters of various types each containing 25 ft. of cord (Cordacide) impregnated with DDT (not less than 20 per cent. by weight of the cord and not less than 0·45 gm. per ft.) to be burnt to provide an insecticidal smoke [*cf. R.A.E.*, B **37** 105]. The smoke produced is stated by the makers to remain in the air for 1–2 hours, penetrating cracks and crevices and finally leaving a uniform deposit of DDT on all surfaces. Dosages of 1 ft. of cord per 60 cu. ft. for most household insects and 1 ft. per 30 cu. ft. for more resistant ones, such as carpet beetles, are recommended, and laboratory tests of deposits from these dosages against carpet beetles and some insects attacking stored products are described [*cf.* A **38** 444]. It is concluded from the results and other experience of the authors with aerosols of the smoke type that exposed susceptible insects would probably be killed, but that penetration of the smoke into hidden areas is insufficient to destroy resistant insects in them.

WEST (T. F.) & CAMPBELL (G. A.). **DDT and newer persistent Insecticides.**—2nd edn. revd., $8\frac{3}{4}\times5\frac{1}{2}$ ins., xiv[+1]+632 pp., frontis., 13 pls., 2 graphs, many refs. London, Chapman & Hall, Ltd., 1950. Price £2 10*s*.

This second edition of the authors' review of the nature and uses of DDT has been considerably expanded to include work subsequent to that noticed in the first [*R.A.E.*, B **34** 170], and a section (pp. 501–568) on some of the newer chlorinated-hydrocarbon insecticides has been added. Both sections cover the literature published up to the end of 1946 and a very few papers published in 1947, but a classified bibliography of additional references up to the end of 1948 is given as an appendix. The new section contains a review of the discovery of the insecticidal properties of benzene hexachloride, its chemistry, methods of preparing it, the forms in which it can be applied against insects, its toxicity to mammals, and work in different countries on its use against Arthropod pests of medical and veterinary importance and pests of plants and stored products, together with shorter reviews of work on the discovery, chemistry and uses of chlordan, and the preliminary results obtained with toxaphene, DDD (dichlordiphenyldichlorethane) and a few other halogenated hydrocarbons.

Statens Skadedyrlaboratorium. Årsberetning 1948–1949. [Danish National Pest Infestation Laboratory. Annual Report 1948–49.] — 26 pp. Springforbi, 1949. (With Summaries in English.)

It is recorded in the first section of this report that applications of DDT to give toxic deposits for the control of house-flies [*Musca domestica*, L.] in Denmark appeared to be less effective in the autumn of 1947 than they had been before, and applications in early 1948 gave very unsatisfactory results. Investigations showed that resistance to the insecticide had developed [*cf.* *R.A.E.*, B **38** 187], and six resistant strains of flies were established in the laboratory and compared with normally susceptible flies reared there since 1945. Resistance to DDT was maintained through the succeeding generations and was accompanied by equal resistance to methoxy-DDT (methoxychlor) and fluoro-DDT (Gix), but flies resistant to these insecticides were as susceptible as the susceptible strain to others, including BHC (benzene hexachloride), chlordan and toxaphene. Spraying alternately with BHC and chlordan was therefore recommended for 1949.

KEMPER (H.). **Die Haus- und Gesundheitsschädlinge und ihre Bekämpfung. Ein Lehr- und Nachschlagebuch für den Schädlingsbekämpfer.** [Pests of household and medical Importance and their Control. A Reference Book for Pest Control Operators.]—2nd edn., $9\frac{3}{4}\times7$ ins., xi+344 pp., 242 figs., 2 pp. refs. Berlin, Duncker & Humblot, 1950. Price 18 *DM*.

This handbook was compiled chiefly for pest control operators in Germany and deals largely with the identity, habits and control of the pests, mostly insects, that they are likely to encounter in buildings as destructive to fabric, furniture, clothing or stored products, harmful to human health or merely a nuisance. The emphasis throughout is on practical considerations. The introductory chapters contain discussions of the duties of pest control operators, the knowledge they should possess and the economic and hygienic importance of various types of pests. Accounts are then given of the zoological classification of pests, the morphology of Arthropods and the various ways in which pests are dependent on external conditions, followed by a list of the principal domestic pests arranged according to their environment, their food habits or the traces they leave behind. The two main chapters contain information on the appearance, bionomics, importance and control of individual pests, or groups of pests, arranged systematically, and the methods available for the prevention and control of various types of infestations, with a review of insecticides, their modes of action and methods of application. A summary of German legal provisions regulating the sale and use of poisons is appended.

SERGENT (Ed.). **Insecticide D.D.T. et tiques du boeuf. Deuxième note.**—*Arch. Inst. Pasteur Algérie* **26** no. 1 pp. 15–20, 7 graphs, 2 refs. Algiers, 1948.

An account is given of a field experiment in Algeria in which 13 cattle were dusted with 25 gm. 5 per cent. DDT powder per animal once a fortnight throughout the hot season (6½ months) for the control of ticks, the powder being worked in with a soft brush, 15 were sprayed with one litre each of a 0·4 per cent. emulsified solution of DDT and brushed at the same intervals and 25 served as untreated controls. All the cattle were kept together and were examined fortnightly for the presence of ticks. The infestation curves for the three batches were practically identical, though the range of infestation on individual animals was great. It is concluded that DDT does not prevent ticks from attaching to cattle or make them detach subsequently, and the earlier laboratory experiments indicating that it is of no practical value in the control of cattle ticks [*R.A.E.*, B **36** 181] were thus confirmed.

GRAHAM (N. P. H.) & SCOTT (M. T.). **Observations on the Control of some Ectoparasites of Sheep. 1. The Use of Arsenic, Rotenone, Sulphur, and Phenol Compounds for the Control of the Sheep Ked** (*Melophagus ovinus*) **and the Sheep Body Louse** (*Damalinia ovis*).—*J. Coun. sci. industr. Res. Aust.* **21** no. 4 pp. 252–265, 9 refs. Melbourne, 1948. **2. Progress Report on the Use of DDT and Benzene Hexachloride for the Control of the Sheep Ked** (*Melophagus ovinus*) **and the Sheep Body Louse** (*Damalinia ovis*).—*T. c.* pp. 266–274, 12 refs.

The following is substantially the authors' summary of the first part of this paper, which comprises accounts of tests in Australia of the individual efficiency of the four common ingredients of sheep dips (arsenic, rotenone, sulphur and phenols) in eliminating infestations of keds (*Melophagus ovinus*, L.) and lice (*Damalinia ovis*, L.) [*cf. R.A.E.*, B **35** 71]. *In vitro* and dipping tests showed that arsenic did not eradicate the ked, but in the form of sodium arsenite, it was effective in eliminating infestations of *Damalinia*. Laboratory and field trials showed that rotenone, when used in the natural product (timbo suspension) or in the pure form at concentrations of about 0·0025 per cent., is very toxic to adult keds but is not lethal to the pupae. Although timbo appeared to have some lasting toxicity in the fleece, this was insufficient to kill all adults emerging from pupae that were left. Rotenone was ineffective against *Damalinia*. Lime-sulphur and colloidal sulphur were ineffective against *Melophagus*. Phenols were effective against the adult keds when used at about 0·5 per cent., but did not kill pupae. The effectiveness of all these insecticides in the field, particularly against *M. ovinus*, varied according to the condition of the sheep and the length of wool they were carrying. The poor wetting properties of most of the dips used also lowered their effectiveness.

In the second part, numerous experiments on the effectiveness against the two pests of dips and a spray containing DDT and dips containing BHC (benzene hexachloride) are described. Earlier work is reviewed [*R.A.E.*, B **34** 190 ; **35** 195 ; **36** 13, 56, 57]. In preliminary tests against *Melophagus*, made in 1945 with a mayonnaise-type emulsion concentrate containing 20 per cent. DDT, all keds were killed within 48 hours on some sheep treated with 0·02 per cent. DDT and adults emerging from pupae on these sheep were also killed [*cf.* **35** 71], but kill was not complete on other sheep in the same test or on those treated with 0·01 per cent. DDT or less. In field trials, 0·04 per cent. DDT in the emulsion failed to give control, except on the first three sheep dipped, owing to a fall in the DDT content of the bath [**36** 118]. In preliminary tests with Rucide (a 50 per cent. p,p′ DDT paste giving a suspension [*cf.* **36** 101]), kill was complete with 0·01 per cent. DDT or over, but 0·005 per cent. gave only partial control. In field trials, a dip charged with 0·034 per cent. DDT as Rucide gave complete control on shorn sheep, even when the content had fallen to 0·025 per cent., but a few keds were found on unshorn lambs. A dip in which the DDT content was maintained at about 0·05 per cent. throughout gave complete control on all but one of nearly 100 sheep examined out of more than 900 treated. Sheep passed through a dip that contained 0·075 per cent. DDT at the beginning and 0·065 per cent. at the end were free of keds four days later. One living ked was found after a month. In another test with a dip that was frequently replenished so that the DDT content varied from 0·056 to 0·09, numerous pupae and a few newly emerged adults were seen on unshorn lambs seven days after dipping but none on shorn sheep or on the lambs after four weeks. When Rucide suspension containing 0·08 per cent. DDT at the outset was applied in a power spray unit in which the sump was the reservoir, the sheep sprayed early were freed of keds, but the suspension lost its effectiveness, and at the end, it was found to contain only 0·02 per cent. DDT [*cf.* **36** 93].

DDT in the emulsion dip eliminated infestation by *D. ovis* only at the highest concentration tried (0·04 per cent.), but as Rucide, it seemed to be effective at as little as 0·01 per cent. Dips containing this amount or more gave complete control in field tests. Lower concentrations were not tried.

Most tests of BHC against *M. ovinus* were carried out in 1945 with an emulsion concentrate incorporating 15 per cent. BHC said to contain 10 per cent. γ isomer. Concentrations of 16 parts γ isomer per million gave complete initial kill but did not prevent reinfestation from pupae, and dips containing 25–76 p.p.m. also gave complete initial kill but allowed reinfestation after 3–4 weeks in later dipped sheep. With 760 p.p.m., there was a satisfactory deposit, and all sheep were free of keds after five weeks. In 1947, a dispersible powder containing 6 per cent. γ isomer became available. Concentrations of 10–50 p.p.m. γ isomer in this form rapidly killed adult keds present and all those that emerged from pupae left on the fleece. All sheep were free from infestation one month after dipping.

Sheep dipped in 50 p.p.m. γ isomer from the emulsion or as little as 10 p.p.m. from the dispersible powder were freed of *D. ovis* and were still free after a month.

It is concluded that if the concentration is satisfactory, DDT and BHC should prove highly effective for the eradication of *M. ovinus* and *D. ovis*. They do not kill the pupae of the former or the eggs of the latter, but remain toxic in the fleece long enough to kill the resulting adults or nymphs. It is necessary to allow for a considerable decrease in the concentration of the dip when fixing the original strength or to add more concentrate as dipping proceeds. The extent to which the concentration falls depends largely on the relation between the number of sheep treated and the volume of dip used.

NAUCK (E. G.) & WEYER (F.). **Der Erreger der "epidemischen Bronchopneumonie des Menschen" (Herzberg) und seine Beziehung zur *Rickettsia burneti* (Q fever).** [The causal Agent of the "epidemic Bronchopneumonia of Man" (Herzberg) and its Relation to *R. burneti* (Q Fever).]—*Z. Hyg. InfektKr.* **128** pt. 5–6 pp. 529–550, 8 figs., 33 refs. Berlin, 1948.

The object of the work described was to establish the identity of an infectious agent that was originally isolated from the blood of persons suffering from epidemic bronchopneumonia in Greece, was maintained in guineapigs and proved pathogenic to mice through intranasal instillation. It resembled rickettsiae in morphological and staining properties, but was filterable. The strain used was obtained in 1947 in the form of triturated organs of infected guineapigs adsorbed on aluminium hydroxide and was maintained by passages through guineapigs and mice, chiefly the latter. A higher proportion of infections was obtained with intraperitoneal inoculation than with intranasal instillation.

American workers have shown that a similar epidemic disease (Balkan grippe) observed in Greece and other Mediterranean countries is caused by *Rickettsia burneti*, the agent of Q fever [*R.A.E.*, B **37** 194]. In the absence of a laboratory strain of *R. burneti*, the organism under study was compared with typhus rickettsiae (*R. prowazekii* and *R. p. mooseri*) and with the virus of bronchopneumonia of mice; it conferred no immunity against *R. prowazekii* in guineapig. It did not become localised in the lungs of the animals except following intranasal instillation, when it occasionally did so and then sometimes led to death. The symptoms and course of infection were in these cases much less violent than those caused by lung infection with the other three agents and it was not always possible to demonstrate the presence of the organism in lung tissue. Intraperitoneal injection caused infection in various internal organs, particularly the spleen, from which the organism was recovered in abundance.

In experiments on the behaviour of the strain in Arthropods, body lice [*Pediculus humanus humanus*, L.] and fleas (*Leptopsylla segnis*, Schönh.) were infected by rectal injection of infected mouse organs, and ticks (*Dermacentor marginatus*, Sulz., and *Ornithodoros moubata*, Murr.) and larvae of the flour beetle (*Tenebrio molitor*, L.) by injection into the body cavity. The Arthropods were dissected at various intervals after injection and the whole body contents or individual organs injected into mice intranasally or intraperitoneally. Smears of the organs, or parts of them, were also prepared. In one or other of these ways, the causal agent was isolated from lice that had been infected 4–24 days previously (and also from their excreta), from fleas infected 5–13 days previously and from ticks infected 8–282 days previously. Infection in mice was also produced by intranasal or intraperitoneal injection of the coxal fluid secreted during feeding by examples of *O. moubata* infected up to 67 days previously. The organism was found to multiply in the tissues of the fleas and ticks, occurring intra- and extracellularly. Transmission was also effected by the excreta of ticks on the 15th and 24th day after infection. In the case of the *Tenebrio* larvae, the organism multiplied to an unusual extent in the whole region of the fat-body, the maximum being reached in about ten days, and the larvae usually died.

Similar experiments on the artificial infection of ticks and lice with the viruses of mouse bronchopneumonia and human influenza (types A and B) and the other insects with the mouse virus were negative, except that a few lice apparently became infected with the latter. It is stated in a footnote that natural infection of ticks, fleas and lice with the experimental organism has since been obtained, with transmission by bite in the case of the ticks.

The morphology of the organism and its localisation in mouse organs are discussed. It is concluded that it belongs to the group of the rickettsiae, although it shows some properties similar to those of viruses, and its identity with *R. burneti* is considered highly probable.

SMART (J.). **Lice.**—*Econ. Ser. Brit. Mus.* (*nat. Hist.*) no. 2A (2nd edn.), 31 pp., 3 figs., 10 refs. London, 1948. Price 9*d*.

The information in the previous edition of this pamphlet [*R.A.E.*, B **30** 158] on lice that occur on man (*Pediculus humanus humanus*, L., *P. h. capitis*, Deg., and *Phthirus pubis*, L.) has been brought up to date, mainly by the inclusion of information relating to their control by DDT.

ROY (D. N.) & GHOSH (S. M.). **A new Treatment of Scabies.**—*Indian med. Gaz.* **82** no. 7 pp. 380–381, 3 refs. Calcutta, 1947.

As phenyl cellosolve (ethylene glycol monophenyl ether) has been shown to be effective against lice [*R.A.E.*, B **38** 179, etc.], it was hoped that it might be useful in the treatment of scabies. It is freely miscible with absolute alcohol and vegetable oil but not with mineral oil. Experiments have shown that the oily mixture does not irritate abraded skin, harm the eyes, or produce any ill effect when applied externally over the whole body. Individuals of *Sarcoptes scabiei*, Deg., brought into contact with 10 or 15 per cent. phenyl cellosolve in groundnut oil for 5–10 seconds died within two or three minutes. The 10 per cent. mixture was therefore tried in the treatment of 35 cases of scabies among Indians. When possible, a bath with soap and hot water was taken in the morning to open the burrows, and after drying, the mixture was applied with cotton-wool to the whole body or the affected parts only. Septic ulcers were cleaned and treated. Further applications were made at night and whenever irritation was felt. The results are to be published.

PAPERS NOTICED BY TITLE ONLY.

HOPKINS (G. H. E.). **Annotated and illustrated Keys to the known Fleas of East Africa** [Kenya, Tanganyika, Uganda and Zanzibar].—*Uganda J.* **11** no. 2 pp. 133–190, 146 figs., 35 refs. London, 1947.

PHILIP (C. B.). **Corrections and Addenda to a Catalog of Nearctic Tabanidae.**—*Amer. Midl. Nat.* **43** no. 2 pp. 430–437, 12 refs. Notre Dame, Ind., 1950. [*Cf. R.A.E.*, B **38** 40.]

CRAIGHEAD (F. C.) & others. **Insect Enemies of eastern Forests** [including Arthropods that attack man or domestic animals in them].—*Misc. Publ. U.S. Dep. Agric.* no. 657, 9¼×6 ins., ii+679 pp., 197 figs., 440 refs. Washington [D.C.], 1950. Price $2.50 (from Supt. Documents). [See *R.A.E.*, A **38** 444.]

MUESEBECK (C. F. W.). **Common Names of Insects** [and other Arthropods] **approved by the American Association of Economic Entomologists.**—*J. econ. Ent.* **43** no. 1 pp. 117–138. Menasha, Wis., 1950. [Superseding previous list (*R.A.E.*, B **36** 24).]

WELSH (J. H.) & GORDON (H. T.). **The Mode of Action of certain Insecticides on the Arthropod Nerve Axon.**—*J. cell. comp. Physiol.* **30** no. 2 pp. 147–171, 6 figs., 34 refs. Philadelphia, Pa., 1947. [See *R.A.E.*, A **38** 458.]

KUITERT (L. C.) & HITCHCOCK (J. D.). **Observations on** *Anopheles leucosphyrus* **Don. at Shingbwiyang, Burma (Diptera, Culicidae).**—*Proc. ent. Soc. Wash.* **50** no. 4 pp. 77–82, 1 graph, 2 refs. Washington, D. C., 1948.

The results are given of observations on the breeding places, prevalence and relation to malaria of *Anopheles leucosphyrus*, Dön. [*cf. R.A.E.*, B **36** 203, 204 ; **37** 175] at Shingbwiyang, in northern Burma, in 1944. The area includes a river, open and thickly wooded swamps and steep hills with dense jungle vegetation and numerous winding streams. The soil is soft and deep, so that large ruts are easily made and abundant pools are formed in the rainy season (April to September), and clearing of camp sites had made very varied shade conditions around these pools. Meteorological data for part of 1944 are given ; rainfall was particularly heavy in June, July and September. Collections of Anopheline larvae were begun in February, and larvae of *A. leucosphyrus* were first found in March, in pot-holes in large rocks along the river and in pools made by floatage in mountain streams. They were later found in rain puddles with either muddy or grassy bottoms, shady or sunlit slit trenches, a large reservoir formed by damming a stream, clear water or water polluted with decaying leaves in pot-holes, shallow seepage pools, small shady swamps and artificial containers. Their numbers increased markedly in early May, and they were found in more than half the collections made throughout June and early July, when they constituted more than 60 per cent. of the Anopheline larvae identified. They became comparatively scarce in August and September, but their numbers increased again in October–December. The percentage of *A. leucosphyrus* among adult Anophelines reared from pupae collected in the field rose from 6 in April to 88 in June, fell to 13 in August and rose again to 72 in November. The species was predominant in adult catches throughout June, July and August, comprising 80 per cent. or more of the catch in the latter two months. Most of the adults were found out of doors, but a few were taken inside tents and warehouses. Of 112 females dissected for malaria parasites, three contained sporozoites. In two of these, in addition to typical sporozoites of human malaria, there was a larger number of atypical forms, the appearance of which is briefly described. It is possible that the atypical appearance may have been the result of distortion due to technical methods. Of 112 females dissected from the neighbourhood of Ledo, Assam, four, taken at a native labour camp, had gland infections. The malaria rate per 1,000 at Shingbwiyang for the year is shown on a graph. A sharp rise in the rate in July was significantly correlated with the percentage of *A. leucosphyrus* among the total larvae identified and with rainfall. The rise in numbers of larvae during October and November was not reflected in the malaria incidence. Adult collections were negligible during this period, possibly partly because a programme of spraying with 5 per cent. DDT in oil was in force by that time. It is concluded that *A. leucosphyrus* is an efficient vector of malaria in the area.

MACKERRAS (I. M.). **The Australasian Anophelines as Vectors of Malaria.**—*Med. J. Aust.* January 4, 1947, pp. 1–8, 27 refs. Sydney, 1947.

The following is virtually the author's summary. The vector qualities of the Australasian Anophelines are examined under the following headings : susceptibility to infection, abundance, association with man, avidity for human blood and length of life. The Milne Bay, New Guinea, population of *Anopheles punctulatus*, Dön., is pre-eminent in all these respects. Of the species that are sufficiently abundant to merit consideration, *A. punctulatus* and *A. farauti*, Lav., are proved dangerous vectors, *A. annulipes*, Wlk., *A. bancrofti bancrofti*, Giles, *A. subpictus*, Grassi, *A. amictus amictus*, Edw., and *A. a. hilli*, Woodhill & Lee, are potential vectors under locally favourable conditions, and

A. meraukensis, Venhuis, and *A. novaguinensis*, Venhuis, are of undetermined status but cannot be of more than local significance. The primary vectors in New Guinea and the islands are *A. punctulatus* and *A. farauti* [*R.A.E.*, B **37** 128, etc.], *A. farauti* is the vector in northern Queensland [**36** 134], *A. annulipes* is the presumptive vector of sporadic malaria in the south [**36** 137] and the vectors in the Northern Territory are still undetermined.

It is considered that there is no reason to expect any change in the distribution and amount of malaria on the mainland of Australia, unless a new vector is introduced. The possibility that *A. punctulatus* might be transported into the tropical parts of the mainland is a danger to be guarded against.

ROBERTS (F. H. S.). **The Distribution and seasonal Prevalence of Anopheline Mosquitoes in north Queensland.**—*Proc. roy. Soc. Qd* **59** pt. 2 pp. 93–100, 9 refs. Brisbane, 1948.

In connection with the concentration of troops in northern Queensland, particularly around Townsville and Cairns, thorough surveys were made to determine the Anophelines present and obtain information about them. Before 1942, *Anopheles annulipes*, Wlk., *A. bancrofti bancrofti*, Giles, and *A. amictus*, Edw., represented by the typical form and subsp. *hilli*, Woodhill & Lee [*R.A.E.*, B **33** 94], had been recorded from northern Queensland, and six other species of *Anopheles* and *Bironella gracilis*, Theo., were recorded later. *A. farauti*, Lav., is thought to be the only considerable vector of malaria in Queensland. Notes are given on the physical characters and climate of the area studied (the coastal area from Townsville to Cairns, the Cairns hinterland and the country west of Townsville) and on the geographical and seasonal distribution and prevalence of the various species there. *A. farauti* was common on the coastal plain [*cf.* **36** 135]; its distribution appeared to be related to the presence of rain-forest, which seemed to provide the moist sheltered resting places required by the adults, and by altitude. The highest altitude at which it was found was 1,300 ft., although there are large areas of rain-forest on the Atherton Tableland (above 2,000 ft.) and Lee has recorded it from altitudes up to 5,800 ft. in New Guinea. *A. annulipes* was widespread, and its larvae were dominant in open forest country, being present up to 3,000 ft., but rare in parts of Cairns city favoured by *A. farauti*. They were found in isolated pools. *A. amictus amictus* was found throughout the area except at very high altitudes on the tableland, and was common at Townsville, where larvae were frequent on the edges of fresh-water swamps. Water with a heavy clay suspension and frequently foul from pollution seemed to be preferred. Larvae of *A. amictus hilli* were seen only in sunlit, brackish, sometimes much polluted, swamps along the coast. This variety sometimes attained pest proportions. Larvae of *A. meraukensis*, Venhuis, were apparently widely distributed on the coastal plain, but were never numerous. *A. b. bancrofti* was common on the coastal plain, particularly near Cairns, but rare on the tableland. Larvae were never numerous in any particular pool. *A. stigmaticus*, Skuse, bred in shaded, clear, cool rock-pools up to altitudes of 3,000 ft., but did not occur in the coastal plain. *A. atratipes*, Skuse, was seen only on the tableland. *A. novaguinensis*, Venhuis, and *A. powelli*, Lee, have been recorded in northern Queensland [**33** 94], but were not seen by the author.

Observations over 18 months indicated a definite seasonal succession of the commoner Anophelines. *A. amictus hilli* was dominant for the first two months of the year [**36** 135], then *A. farauti* until about June. *A. annulipes* followed, and finally *A. amictus amictus*. This succession is considered to be associated mainly with changing conditions of humidity brought about by the seasonal distribution of rainfall. Malaria transmission in the district is discussed, and it is suggested that *A. farauti*, which is there relatively zoophilous, can be associated with epidemics only in seasons when it is particularly abundant and remains so for a long time and that epidemic years are characterised by a prolonged wet season and a relatively mild winter.

Barber (G. W.), Starnes (O.) & Starnes (E. B.). **Resistance of House Flies to Insecticides.**—*Soap & sanit. Chem.* **24** no. 11 pp. 120–121, 143. New York, N.Y., 1948.

Four lines of *Musca domestica*, L., were established from one jar culture of a current laboratory line from Florida. In ten successive generations, all individuals of one line were treated with p,p′DDT, all of a second line with extract containing 20 per cent. pyrethrins and all of a third line with "extractives of a botanical". The fourth line served to provide controls, and in each generation the individuals of this line that were used for breeding were untreated. The insecticides in acetone solution were applied at dosages found previously to cause 50 per cent. mortality with an apparatus calibrated to deliver 0·002 ml. solution per drop to the thorax of flies immobilised with carbon dioxide. The measured-drop technique assured that each fly received an identical dose and that none escaped treatment.

A comparison of the rates of mortality of flies of the treated lines with those of the flies of the control line that received the same treatment showed that in most generations fewer flies died in the treated lines than in the treated controls. Apparently, resistance had been acquired to each of the insecticides [*cf. R.A.E.*, B **38** 209], and this resistance was measurable by the second generation.

The weights of puparia of the treated lines averaged 18 mg. and of puparia in the control line 16 mg. In the cultures treated with DDT, pyrethrins and the botanical extract, the average percentages of puparia that failed to give rise to adults were 5, 2·9 and 8·2 greater than in the untreated controls.

Fales (J. H.), Nelson (R. H.), Ball (W. H.) & Fulton (R. A.). **Storage of Aerosols.**—*Soap & sanit. Chem.* **24** no. 11 pp. 127, 129, 2 refs. New York, N.Y., 1948.

In tests in which an aerosol solution consisting of pyrethrum extract (20 per cent. pyrethrins), sesame oil and Freon-12 (dichlordifluoromethane) (2 : 8 : 90) and one of pyrethrum extract, DDT, cyclohexanone, lubricating oil and Freon-12 (2 : 3 : 5 : 5 : 85) that had been stored for two years were compared with the same mixtures freshly made against freely flying house-flies (*Musca domestica*, L.) in a Peet-Grady chamber, the knockdown and kill were about equal for stored and freshly made formulations released at the same rates. The first was tested again after storage for three, four and five years and still showed no differences from the freshly prepared mixture. When the DDT solution and another consisting of pyrethrum extract, DDT, alkylated naphthalene and Freon-12 (2 : 3 : 15 : 80) were kept in an oven for 26 days at 60°C. [140°F.] and tested against house-flies at rates regulated by the swinging-shutter method and averaging 0·39 gm. per 1,000 cu. ft., the former gave an average mortality of 48 per cent. in one day, as compared with 34 per cent. for an unheated sample, whereas the latter gave 46 per cent., as compared with 55 per cent. when freshly prepared. When the second of these mixtures and the one without DDT were heated for five hours at 85°C. [185°F.] while the paint was being baked on the containers and tested at average rates of 1·4 and 9·26 gm. per 1,000 cu. ft., respectively, the first gave averages of 41 per cent. knockdown in 15 minutes and 80 per cent. kill in one day, as compared with 47 and 76 per cent. for the unheated combination, and the second 83 per cent. knockdown and 70 per cent. kill, as compared with 90 and 67 per cent.

Steel containers in which a solution of DDT, cyclohexanone and Freon-12 (5 : 10 : 85) and one of pyrethrum extract, DDT, lubricating oil, propylene oxide and Freon-12 (2 : 3 : 5 : 5 : 85) had been stored for 36 and 15 months, respectively, showed corrosion, whereas others that had contained pyrethrum extract, DDT, cyclohexanone, lubricating oil and Freon-12 (2 : 3 : 5 : 5 : 85) or pyrethrum extract, sesame oil and Freon-12 (2 : 8 : 90) for 36 months did not. One that had contained pyrethrum extract, DDT, lubricating oil and Freon-12 (1 : 1 : 9 : 89) for 22 months had an oil ring and a black residue below the solution level. Heating the containers before they were filled was found to accelerate corrosion.

KRUSE (C. W.). **Roach Control.**—*Soap & sanit. Chem.* **24** no. 11 pp. 131, 133, 135, 137, 139, 169, 2 figs., 9 refs. New York, N.Y., 1948.

After a discussion of how infestation by cockroaches, principally *Blattella germanica*, L., the most difficult to control, may be reduced in food-handling establishments by designing structure and equipment to reduce harbourages and promote cleanliness and dryness, an account is given of experiments made to compare the merits of various synthetic insecticides against *B. germanica*. Initial experiments on the toxicity to adults of DDT in different solvents applied to glass at 100 mg. technical DDT per sq. ft. showed that contact for 30 minutes was not long enough to give satisfactory kill 24 hours after application. The solvents used were a polymethyl naphthalene (Velsicol AR-60), kerosene, xylene or acetone, given in order of increasing volatility, and mortality varied with the volatility of the solvent [*cf.* *R.A.E.*, B **37** 229]. After 24 hours, it was about 60 per cent. with Velsicol AR-60, 75 with kerosene, 25 with xylene and 0 with acetone. After a longer period, it was lower with kerosene than with Velsicol AR-60. The crystallised DDT could be reactivated by applying one ml. kerosene per sq. ft. to the glass [*cf.* **37** 230]. This raised toxicity to 100 per cent., after which it gradually fell off again. Uniformly distributed or sharp crystals appeared to be less effective than heavily clumped ones. DDT was more effective in dust diluents, but attempts to determine the relative merits as diluents of lime, talc, silica and activated carbon were unsuccessful, as exposure for one minute always gave complete mortality in 24 hours. A method designed to ensure contact for less than one minute is described, but even when it was used, no significant differences in mortality could be found between the different diluents, and it is concluded that any highly micronised diluent would be satisfactory [but *cf.* **38** 66].

Some 250 tests involving about 15,000 adults of *B. germanica* were made to investigate the average time of contact needed to give satisfactory kill in 24 hours with deposits of various insecticides at different rates of application. The materials tested were dusts of undiluted technical DDT, 50 per cent. chlorinated camphene [toxaphene] in talc, and 50 per cent. BHC (benzene hexachloride) and solutions of 5 per cent. DDT in kerosene, 5 per cent. chlordan in deobase and 11 per cent. BHC (12 per cent. γ isomer) in cyclohexanone. The mortality percentages obtained with increasing contact periods on surfaces treated at 1,000, 500, 100, 50 and (for the BHC dust only) 10 mg. per sq. ft. technical insecticide were determined. The results were plotted, and the time and concentration giving 90 per cent. kill determined by extrapolation and confirmed by additional experiments. The sprayed panels were allowed to dry for 24 hours before the cockroaches were exposed. Some of the basic data are summarised in tables. With BHC dust, there was no real difference in mortality as exposure increased from 1 to 30 seconds. The differences in kills with dosages of 10 and 50 or 100 mg. were much more significant. With DDT and toxaphene dusts, differences in kill achieved with various contact times below 30 seconds were real for rates of 100 mg. per sq. ft. but not for higher ones. Change of rate did not significantly affect kill, except with contact for one second. More significant differences were obtained with solutions than with dusts, largely because the contact times compared ranged from 1 to 60 minutes.

The results show that BHC was the most effective material tested, but its odour would limit its use in some environments. Little appeared to be gained by applying it at more than 50 mg. actual BHC per sq. ft., or by applying dusts of toxaphene or DDT at more than 200 mg. insecticide per sq. ft. Chlordan should be applied at about 500 mg. per sq. ft., and for DDT used as a spray, an even higher rate is desirable to give any appreciable results.

An experiment on the practical control of *B. germanica* was made in a heavily infested room in which animals were kept ; the BHC dust was applied as a barrier deposit under cages, around walls and in drawers at 50 mg. actual BHC per sq. ft. The total numbers of cockroaches present before and six days after treatment were estimated by counting, marking and releasing one day's catch and noting the proportion of recaptured marked individuals among the total catch a day or two later. The estimates indicated that treatment had reduced the population by about 96 per cent. It began to increase again after a month.

FULTON (R. A.). **Propellents for low-pressure liquefied Gas Aerosols.**—*Industr. Engng Chem.* **40** no. 4 pp. 699–700, 3 refs. Easton, Pa., 1948.

Since liquefied dichlordifluoromethane (Freon 12) exerts a vapour pressure of about 85 lb. per sq. in. at room temperature, aerosol solutions in which it is the propellent require special containers, which are expensive. Attempts were accordingly made to develop low-pressure aerosol solutions, exerting a total pressure of 25–40 lb. per sq. in. at 70°F., which may be used in light containers. Various combinations of solvents and liquefied gases were studied to determine the pressures of the resulting solutions. The more effective of the mixtures tested as propellents were trichlorfluoromethane (Freon 11) and Freon 12 ; methylene chloride and Freon 12 ; pentane, Freon 11 and Freon 12 ; deodorised kerosene and Freon 12 ; propane and methylene chloride ; methylene chloride, Freon 12 and carbon dioxide ; 1,1-difluoroethane and Freon 11 ; and 1,1,1-chlordifluoroethane and Freon 12. Combinations of Freon 11 and Freon 12 in a number of low-pressure formulae containing various proportions of DDT and pyrethrum extract appeared to be satisfactory. As Freon 11 is a better solvent for DDT than Freon 12, the amount of auxiliary solvent, such as cyclohexanone and unsaturated hydrocarbons, could be reduced, but with this mixture it was necessary to avoid the use of the high-boiling fractions of the unsaturated hydrocarbons, which caused the mixtures to separate and so increased the vapour pressure in proportion to the amount of solvent added. A mixture of equal quantities of methylene chloride and Freon 12 gave a vapour pressure of 41 lb. per sq. in. at 70°F., which was reduced to about 37 lb. after addition of pyrethrum extract, DDT and solvents. Less solvent was required for the DDT when methylene chloride was used instead of Freon 11. Pentane was incorporated with the mixture of the two Freons to lower the vapour pressure, but there appeared to be no advantage in its use because of its poor solvent properties. Approximately 70 per cent. deodorised kerosene was required to lower the vapour pressure of Freon 12 below 40 lb. per sq. in., and the resulting mixture was oily and produced a very coarse mist. Propane and methylene chloride (15 : 85) made a good propellent, but stratification of the two vapours could cause a danger of fire. The addition of carbon dioxide to methylene chloride containing approximately 5 per cent. Freon 12 increased the pressure of the solution, and the large proportion of methylene chloride eliminated the necessity for auxiliary solvents. However, if the carbon dioxide was lost by faulty mechanism before the contents were used, the performance of the remainder would be unsatisfactory. When 1,1-difluoroethane was added to Freon 11, auxiliary solvents were required ; 1,1,1-chlordifluoroethane and Freon 12 formed a satisfactory propellent with auxiliary solvents to hold the DDT in solution.

It is concluded that there are a number of satisfactory propellents for low-pressure aerosols. In developing new formulae, a thorough study of compatibility, pressure and action on the valve mechanism is required, and the use of a release device suited to the particular formula is necessary.

Nelson (R. H.), Fulton (R. A.), Fales (J. H.) & Yeomans (A. H.). **Low Pressure Aerosols—their Efficiency in Relation to Formulation and Particle Size.**—*Soap & sanit. Chem.* **25** no. 1 pp. 120–121, 123, 125, 166, 5 graphs, 5 refs. New York, N.Y., 1949.

In these investigations on low-pressure aerosols for household use, the effects were tested of varying the ratio of volatile ingredients (propellent gas) and nonvolatile ones (insecticide and necessary solvents) on the vapour pressure of the solution and the particle size and insecticidal efficiency of the aerosol. Gauge pressures were taken at intervals of 10° from 70° to 130°F., and insecticidal efficiency determined in tests against adults of *Musca domestica*, L., in a Peet-Grady chamber. Five series of formulations were tested. Those of each series contained equal quantities of insecticidal ingredients but varying ratios of volatile to nonvolatile ingredients. The variation was obtained by changing the amount of solvent. A mixture of equal weights of Freon-11 [trichlorfluoromethane] and Freon-12 [dichlordifluoromethane] was used as the volatile portion in all cases [*cf.* preceding abstract]. The rate of application was 1·16 gm. per 1,000 cu. ft. for formulae containing 0·2 per cent. or more pyrethrins and 2·32 gm. for those containing 0·15 per cent. Such rates gave mortalities of appreciably less than 100 per cent.

The gauge pressures decreased with increasing nonvolatile content in each series, but results as to particle size and insecticidal activity differed between series. In a series of five combinations containing 0·4 per cent. pyrethrins, 2 per cent. DDT and 10, 15, 20, 22 or 25 per cent. nonvolatile material (the increases in which were obtained by the addition of deodorised kerosene), there was a gradual increase in average particle size throughout, a sharp increase in the size of the largest particles between 15 and 20 per cent. nonvolatile content and a sharp drop in knockdown and kill between 20 and 22 per cent. nonvolatile content. In five combinations of 0·15 per cent. pyrethrins and 2 per cent. DDT with 10–25 per cent. nonvolatile compounds, there was a sharp decrease in insecticidal effect as the nonvolatile ratio increased above 20 per cent. and a sharp increase in the size of the largest particles between 20 and 25 per cent. nonvolatile ingredient. In a series of manufacturers' concentrates containing 0·2 per cent. pyrethrins, 1 per cent. sesame-oil extractives and 2 per cent. DDT, in which the amount of nonvolatile material was altered by the addition of the alkylated-naphthalene solvent (PD 544 C) as well as of deodorised kerosene, there was a steady rise in particle size as the percentage of nonvolatile material rose from 10 to 20 per cent. and the break in insecticidal efficiency occurred between 15 and 20 per cent. nonvolatile content. When 2 per cent. n-propyl isome was substituted for sesame-oil extractives and only the deodorised kerosene content was varied, the break in largest particle size occurred between 10 and 15 per cent. nonvolatile content and there was no sharp change in insecticidal efficiency. With 2 per cent. Van Dyk 264 [the N-2-ethylhexylimide of endomethylene tetrahydrophthalic acid, known chemically as N-(2-ethylhexyl)bicyclo[2.2.1]-5-heptene-2,3-dicarboximide] instead of sesame-oil extractives as the synergist and again only the amount of deodorised kerosene changed, particle size and knockdown were similar to those for the sesame-oil combinations but there was no sharp reduction in mortality.

It is concluded that when gauge pressure, particle size and insecticidal effect are considered, formulations containing 10–15 per cent. nonvolatile constituents appear to be the best. Many of the preparations approved and manufactured in the United States during 1948 contained 15 per cent. nonvolatile constituents, but some incorporating pyrethrins, piperonyl butoxide and DDT contained 20 per cent. The data show no sharp changes in particle size or insecticidal effect for formulae of 20 per cent. or less nonvolatile material containing these ingredients, but 20 per cent. is regarded as marginal. The insecticidal efficiency of low-pressure aerosols in general showed negative correlation with nonvolatile content and particle size and positive correlation with gauge pressure. In order to obtain the maximum efficiency from the active ingredients, the deodorised kerosene content of a low-pressure aerosol should be kept at a minimum.

CROSS (H. F.) & SNYDER (F. M.). **Chigger Control. Washing and aging Tests of a selected Group of Compounds effective as Clothing Treatments against Chiggers.**—*Soap & sanit. Chem.* **25** no. 2 pp. 135, 137, 139, 141, 143. New York, N.Y., 1949.

From April 1942 to March 1947, 5,963 chemicals were tested in Florida as treatments for clothing, against Trombiculid larvae [*cf. R.A.E.*, B **38** 29, etc.], of which the principal species identified in the test area were *Eutrombicula* (*Acariscus*) *masoni*, Ewing, and *E. alfreddugèsi*, Oudm. A summary is here given of the results obtained with the 150 materials that were most promising in tests made in 1945 to find substances more resistant to washing than benzyl benzoate. For the 34 of them that withstood more than four washings at 2 gm. per sq. ft., data are tabulated showing the average stopping time [*cf.* **38** 30] before washing, the number of washings withstood and the average number of days' ageing withstood outdoors, in ultra-violet light and indoors in darkness at 2 gm. per sq. ft. and usually at lower rates of impregnation also. Of the 34, 26 were solids. A list is also given of the 116 compounds that withstood 2–4 washings when applied at 2 gm. per sq. ft. The test method is described.

The materials most resistant to washing at 2 gm. per sq. ft. were 95 per cent. γ BHC (benzene hexachloride), which remained effective after an average of 19·3 launderings and had a minimum effective dosage of 0·56 mg. per sq. ft. in fresh treatment, and diphenyl carbonate, diphenyl nitrosoamine, 2-thenyl salicylate, hexachlor-2,5-cyclohexadien-1-one, p-dimethylaminophenyl thiocyanate, p-cresyl benzoate and phenyl benzoate, all of which remained effective after averages of 7–8·5 launderings. Other compounds of which available supplies allowed of only one test each also appeared highly resistant to washing. All the samples impregnated with benzyl benzoate at 0·5–2 gm. per sq. ft. were effective after one washing, but 6 per cent. of those impregnated at 2 gm. failed after the second washing and half after the third. The materials that withstood the longest period of outdoor ageing at 2 gm. per sq. ft. were 2-thenyl salicylate, diphenyl carbonate, di-m-tolyl carbonate, 2-thenyl benzoate, dipentene monocarbinol α-thiocyanopropionate and p-dimethylaminophenyl thiocyanate. Some of the more effective materials withstood 40–50 days each of exposure outdoors and to ultra-violet light. When the better materials were applied at 2 gm. per sq. ft. and then stored indoors in the dark, all of them were still effective 154–249 days after treatment. Benzyl benzoate was still effective after 256 days. Records were made of the rate of recovery of mites exposed for 20 minutes on cloth treated with 28 of the materials. All of those on 11 of the samples recovered, whereas 13 materials allowed no recovery.

Under field conditions, toxicity is not of great importance. Benzene hexachloride may be unsafe on clothing worn for an extended period, diphenyl nitrosoamine stains and some of the other compounds also have disadvantages.

KULASH (W. M.). **DDT for Control of Bedbugs in Poultry Houses.**—*Poult. Sci.* **26** no. 1 pp. 44–47, 2 figs., 4 refs. Menasha, Wis., 1947.

A rather more detailed account than one already noticed [*R.A.E.*, B **35** 27] is given of an experiment in which a spray of 5 per cent. DDT in kerosene was successfully used against *Cimex lectularius*, L., in fowl houses in North Carolina. The houses were still free from infestation a year after treatment.

MOORE (J. B.). **Relative Toxicity to Insects of Natural Pyrethrins and Synthetic Allyl Analog of Cinerin I.**—*J. econ. Ent.* **43** no. 2 pp. 207–213, 7 refs. Menasha, Wis., 1950.

It has been found that complete synthesis of analogues of some of the active principles of pyrethrum flowers is commercially practicable and that the cost of the synthetic allyl analogue of cinerin I, which is the most toxic of them [*cf. R.A.E.*, B **38** 103] and to which the name allethrin is applied, is rather less than that of natural pyrethrins. Seven samples of allethrin were therefore made up into different types of insecticide and compared with similar preparations of natural pyrethrins against various insects [*cf.* also A **38** 506]. The results of assays of the samples by the Seil and mercury-reduction methods are shown.

In tests of aerosols containing pyrethrins, allethrin or both against house-flies (*Musca domestica*, L.) in a Peet-Grady chamber, the two materials proved to be equal in toxicity. The knockdown was enhanced in both cases by the addition of DDT, but the synergistic effect of piperonyl butoxide was considerably less with allethrin than with pyrethrins. In tests of household sprays in a Peet-Grady chamber, a settling mist chamber and a Water's tower (direct-spray method), allethrin was about as effective as pyrethrins against house-flies but gave a slower knockdown, and was inferior to it in both knockdown and kill against cockroaches. The American and German cockroaches [*Periplaneta americana*, L., and *Blattella germanica*, L.] were less susceptible than the oriental cockroach [*Blatta orientalis*, L.]. When carefully measured doses of insecticide were applied to individual insects, the median lethal doses of pyrethrins, allethrin and DDT for house-flies of the laboratory strain were 1, 0·3 and 0·03 mmg., respectively, and those for a strain resistant to DDT were 1, 1 and 11 mmg. Those of pyrethrins and two samples of allethrin for males of *Blattella* were 10–15, 60–66 and 47–52 mg. per kg., and those for females 10–15, 58–64 and 50–55, respectively. The variation between the different allethrin samples was within the error of the testing methods.

In preliminary tests in which sprays containing 0·1 gm. allethrin per 100 ml., were applied by the direct-spray method to *B. germanica* at a dosage of 0·5 ml., additions of 1 and 2 gm. N-2-ethylhexyl imide of endomethylenetetrahydrophthalic acid per 100 ml., 1 gm. piperonyl butoxide, 2 gm. 2-ethylbutyl imide of endomethylenetetrahydrophthalic acid and 1-methylisobutyl imide of the same acid as synergists increased the percentage kill in 72 hours from 2·5 to 12·5, 55, 6·3, 51·2 and 21·2, respectively. At a dosage of 1 ml., they increased it from 11·2 to 82·5, 99, 90, 100 and 96·5. A spray of 0·1 gm. pyrethrins per 100 ml. gave 23·8 per cent. kill at a dosage of 0·5 ml. and 96·2 per cent. at 1 ml. It appears, therefore, that the three imides acted as synergists for allethrin and should be tested further.

It is concluded that allethrin could replace the natural pyrethrins in aerosol bombs and fly-sprays and that it might be used in combination with a synergist to control cockroaches [*cf.* also B **38** 133] and certain field insects.

STERNBURG (J.), KEARNS (C. W.) & BRUCE (W. N.). **Absorption and Metabolism of DDT by resistant and susceptible House Flies.**—*J. econ. Ent.* **43** no. 2 pp. 214–219, 1 fig., 11 refs. Menasha, Wis., 1950.

Some of the literature on the development of resistance to DDT in *Musca domestica*, L. [*cf. R.A.E.*, B **38** 187, etc.] is reviewed, and an account is given of an investigation into the possibility that resistant flies may have developed an abnormal ability to metabolise the compound. The expected metabolites were bis-(p-chlorphenyl)acetic acid (DDA) and 1,1-dichlor-2,2-bis-(p-chlorphenyl) ethylene (DDE). The resistant strain of *M. domestica* used was resistant to both DDT and methoxy-DDT (methoxychlor), 18,728 mmg. of the former or 14,586 mmg. of the latter per gm. female fly being needed to produce a median mortality 24 hours after treatment as compared with 20 mmg. DDT or 26 mmg. methoxy-DDT for the non-resistant laboratory strain. The DDT was applied to the pronotum of individual flies in 1 cu. mm. ethanol, and the little that remained on the surface was removed by rinsing in diethyl ether. The DDT and ether-soluble metabolites were subsequently extracted from the flies with ether after they had been rinsed and ground in the presence of anhydrous sodium sulphate. The methods used to determine the amount of DDT and metabolites in these extracts are described.

The results of the experiments showed that DDT is readily absorbed by both susceptible and resistant strains of house-flies. There was little difference in the initial rate of absorption by the two strains. The rate was greatest when high concentrations of DDT were present on the outside of the body and decreased as the concentration of DDT decreased. Flies that were susceptible to DDT did not metabolise it to form DDE or DDA, but metabolised small amounts to form an unknown compound. Resistant flies rapidly metabolised DDT that had entered the body. The main product of metabolism was DDE, but small amounts of DDA were also formed. Only small amounts of these metabolites were excreted, whereas large amounts were retained in the body. Whether resistance is imparted by the ability to metabolise DDT rapidly after it has penetrated the cuticle is not clear. The small amounts of unchanged DDT recovered from within resistant flies would have been sufficient to kill susceptible flies. It is possible that resistant flies degrade DDT before it reaches its site of action.

FULTON (R. A.), NELSON (R. H.) & SMITH (F. F.). **The Toxicity of Lindane Vapor to Insects.**—*J. econ. Ent.* **43** no. 2 pp. 223–224, 3 refs. Menasha, Wis., 1950.

In work with aerosols for the control of flies in barns, lindane [at least 99 per cent. γ benzene hexachloride] at 0·1 gm. per 1,000 cu. ft. space gave satisfactory control for 7–10 days. Such prolonged effect was unexpected, since aerosols settle only on horizontal surfaces and few flies rested on the floors, which, moreover, were washed daily. Experiments were therefore carried out on the effect of lindane vapour on house-flies (*Musca domestica*, L.) and also on Aphids and thrips, the results for which are noticed elsewhere [*R.A.E.*, A **38** 508]. When cages containing house-flies were suspended overnight (18 hours) from the ceilings of barns that had been treated about 30 days before with a spray made from 25 per cent. water-dispersible lindane powder at the rate of about 25 mg. lindane per sq. ft., about 40 per cent. of the flies were dead or moribund at the end of the exposure. In a similar test in a barn that had been treated with an aerosol two hours before at the rate of 0·1 gm. lindane per 1,000 cu. ft., all the flies died.

When caged house-flies were left overnight (17 hours) in a greenhouse with a cubic content of 1,150 cu. ft. that had been treated with an aerosol released from a mixture of lindane, Velsicol AR-60, acetone and methyl chloride

(1 : 10 : 3 : 86) at the rate of 0·1 gm. lindane per 1,000 cu. ft. five or seven days before and subsequently ventilated daily, 68 and 90 per cent., respectively, were killed. Analysis of the air immediately after the exposures showed that it contained 0·3 and 0·2 mmg. chlorine as lindane per litre. Treatment of greenhouse sections of 7,000 cu. ft. capacity with aerosols at rates of 0·1 and 0·5 gm. lindane per 1,000 cu. ft. with subsequent daily ventilation, resulted in 98 and 100 per cent. mortality of caged flies introduced after one day, 64 and 98 per cent. of those introduced after seven days and 60 and 57 per cent. after 14 days. The air in the two sections contained 0·3 and 0·6, 0·2 and 0·3 and 0·06 and 0·1 mmg. chlorine as lindane per litre after 1, 7 and 14 days, respectively.

When house-flies were exposed for 17 hours in glass chambers of 24 cu. ft. capacity containing air that had passed at the rate of 2 litres per minute through a 4- or a 12-in. column of lindane crystals, 60 and 82–83 per cent. of them, respectively, were killed ; the air after exposure contained 0·3 and 1–2 mmg. chlorine as lindane per litre.

It is concluded that the vapours from lindane applied in an aerosol or a water-dispersible powder spray show fumigating action and that *M. domestica* is susceptible to minute traces of the compound.

GOODHUE (L. D.) & LINNARD (C. E.). **Air Separation Apparatus for cleaning Fly Pupae.**—*J. econ. Ent.* **43** no. 2 p. 228, 1 fig., 2 refs. Menasha, Wis., 1950.

The apparatus described separates the puparia of the house-fly [*Musca domestica*, L.] from the medium used for rearing the larvae. The latter is sifted, dried if necessary and drawn up by a blower (a photographic darkroom drier) through a glass tube from a can with a screen-wire bottom, and the puparia are left. About 99 per cent. of the medium is withdrawn in this way.

MELNICK (J. L.), WARD (R.), LINDSAY (D. R.) & LYMAN (F. E.). **Fly-abatement Studies in urban Poliomyelitis Epidemics during 1945.**—*Publ. Hlth Rep.* **62** no. 25 pp. 910–922, 2 pls., 6 figs., 10 refs. Washington, D.C., 1947.

An account is given of experiments in July-August 1945 in which outdoor applications of 5 per cent. DDT in an emulsified solution delivered from air-blast or spray equipment mounted on vehicles were made to a part of one town in New Jersey (Paterson) and a part of one in Illinois (Rockford) where poliomyelitis epidemics were in progress. Each treated area was about 4 sq. miles in extent. The applications were made at 2 lb. DDT per acre in Paterson and 1·5 lb. per acre in Rockford. In Paterson only, backyard refuse dumps were sprayed with 10 per cent. DDT. A temporary reduction in flies was achieved in both areas, but in the circumstances, which were not very satisfactory, there was no effect on the poliomyelitis epidemic in either area. Lists of the flies observed are included ; blowflies made up the great majority in both towns. The studies indicated some of the difficulties and the cost involved in large-scale work of this nature. The results were inconclusive as poliomyelitis rates at Paterson were hardly at the epidemic level, spraying at Rockford was not begun until after the outbreak had passed its peak, and striking and prolonged fly control was not obtained.

VICKERS (L. G.). **Comparison of some D.D.T. Formulations.**—*77th Rep. ent. Soc. Ont. 1946* pp. 19–20. Toronto, 1947.

The existence of a relation between the toxicity of deposits of DDT and the structure of the crystals formed was investigated in Ontario in 1945–46 by exposing adults of *Musca domestica*, L., to glass surfaces sprayed in the laboratory. In all, 37 emulsified and non-emulsified solutions were tested, the former prepared from concentrates containing 25 per cent. DDT, 68 per cent. solvent and 7 per cent. emulsifier diluted to contain 5 per cent. DDT, and the latter containing 5 per cent. DDT, 15 per cent. solvent and 80 per cent. oil carrier. They were prepared and mixed under identical conditions and applied to give a deposit of 50 mg. DDT per sq. ft. In each test, about 50 flies were exposed for 24 hours in a wire cage to 1 sq. ft. sprayed glass, and the tests with each deposit were repeated at intervals of about 25 days over a period of ten months. The crystals deposited by the emulsions tended to form aggregates varying in size and shape with individual crystals scattered between them, and those deposited by the oil solutions to form straight lines of uniform thickness independent of any foci, though there were minor variations within each class. The deposits from oil solutions gave an average total mortality of 99·2 per cent., and those from the emulsions 95 per cent. No significant correlation was found between the conformation of the crystals and percentage mortality within each class. Two wettable powders were also tested, but the results from them differed too widely to be conclusive.

Penn (G. H.). **The larval Development and Ecology of** *Aedes* (*Stegomyia*) *scutellaris* (**Walker, 1859**) **in New Guinea.**—*J. Parasit.* **33** no. 1 pp. 43–50, 7 figs., 10 refs. Lancaster, Pa., 1947.

The bionomics of *Aëdes scutellaris*, Wlk., were studied at three localities in Papua and two in North-east New Guinea and on two islands off the coast of Netherlands New Guinea. Females fed mainly during twilight hours. They bit throughout the day in dark, shaded, damp places [*cf. R.A.E.*, B **36** 175], but never in direct sunlight. Pairing was observed at dawn in cool, damp, sheltered situations and in a cage measuring 40×20×30 ins. Eggs were laid singly, mainly in cracks, on the sides of containers at and above the surface of the water about a week after the fertilised female had obtained a blood-meal. They hatched in a minimum of 24 hours, but probably require considerably longer in nature. When eggs were allowed to develop for 24 hours on damp filter paper and then air dried at normal temperatures (90–95°F.) for varying periods, hatching was generally progressively delayed and the percentage hatch decreased with an increase in the time that the eggs were kept dry. Only 15 per cent. hatched when this period was twelve days, the maximum tested. When eggs were kept for six weeks on damp filter paper, 80 per cent. hatched. Males and females began to emerge 48 and 84 hours, respectively, after pupation, and the males emerged over a shorter period. The minimum time elapsing from oviposition to adult emergence was 7½ days for males and nine days for females. The characters of the different larval instars are described and illustrated.

Larvae generally occurred in temporary collections of clear, stagnant water, mainly in coconut shells and artificial containers, coconut leaves and fronds [*cf.* **36** 175 ; **37** 129], but also in tree-holes and more rarely in puddles, leaf axils of *Pandanus* spp., bamboo stumps, rock-pools and wells. They were occasionally found in highly polluted water and once in almost pure urine. Breeding places were usually, but not invariably shaded, and the water most frequently had a pH of 6·0–6·5 and a specific gravity of 1·000–1·005, though the range in both cases was wide.

Scott (J. A.), Stembridge (V. A.) & Sisley (N. M.). **A Method for providing a constant Supply of Tropical Rat Mites,** *Liponyssus bacoti*, **infected with the Cotton Rat Filaria,** *Litomosoides carinii*.—*J. Parasit.* **33** no. 2 pp. 138–141, 1 fig., 5 refs. Lancaster, Pa., 1947.

The method described for obtaining a constant supply of *Liponyssus bacoti*, Hirst, infected with *Litomosoides carinii* [*cf. R.A.E.*, B **37** 139] involves the use of a series of galvanised iron tanks, in each of which a colony of mites is reared on a white rat. Each tank measures 12×15×12 ins. and has an oil-filled moat round the outside to prevent the escape of the mites and a hardware cloth cover from which a feeding basket is suspended. A metal basket to hold food for the rat and a tray beneath it are suspended from the cover ; the tray catches the débris and eliminates trouble from cheese mites. A two-inch layer of wood-shavings is placed in the bottom of the tank and covered with hardware cloth and 3–4 ins. of hay. The tray under the feeder is changed about once a week, the mites being removed from the débris. The rat is moved to a clean tank every four weeks or given a rest if suffering from anaemia, and a cotton rat [*Sigmodon hispidus*] infected with *L. carinii* substituted for it. After ten days, the cotton rat is etherised and the mites are brushed off it ; it is usually used again immediately. The mites subsequently crawl up the sides of the tank and are transferred to vials, in which they survive for up to about a fortnight without feeding. About a quarter of the mites so reared are infected.

TRAVIS (B. V.). **Relative Efficiency of six Species of Mosquitoes from Guam, M. I., as developmental Hosts for** *Dirofilaria immitis.—J. Parasit.* **33** no. 2 pp. 142–145, 3 refs. Lancaster, Pa., 1947.

The incidence of *Filaria* (*Dirofilaria*) *immitis* in dogs on Guam was investigated in view of the possible danger of infection to dogs employed in warfare. It was found that 18 out of 20 local dogs were infected. The microfilaria counts ranged from 11,500 to 41,900 per ml. blood in ten of them and from less than 100 to 7,500 per ml. in the other eight. From November 1945 to January 1946, the suitability as intermediate hosts for *F. immitis* of six of the nine species of mosquitos known to occur on Guam was examined. They were dissected 1–2, 3–11 and 12–16 days after having fed on an infected dog, and the percentages infected and the numbers and positions of the larvae in them are shown in tables. Infective-stage larvae were found in those dissected after 12–16 days ; the average number per mosquito and (in brackets) the percentages of mosquitos containing them were 5·5 (68) for *Aëdes guamensis*, Farner & Bohart, 2·3 (57) for *A. pandani*, Stone, 0·2 (2) for *A. aegypti*, L., 0·6 (27) for *Culex annulirostris*, Skuse, 0·4 (23) for *C. fatigans*, Wied. (*quinquefasciatus*, auct.), and 0·2 (15) for *C. sitiens*, Wied. [*cf. R.A.E.*, B **25** 71 ; **32** 16]. *C. fatigans*, *C. annulirostris* and *A. guamensis* did not feed readily on the dog. It was necessary to remove *A. guamensis* and *A. pandani* before they were completely engorged, because otherwise they died within 36 hours, as a result of damage by the larvae. It is likely that under natural conditions, mosquitos of these two species do not survive to develop infective-stage larvae after feeding on a heavily infected dog.

JOHNSON (H. A.) & YATES (M. W.). **DDT in Oil as a Larvicide in an Area ordinarily considered difficult to treat.**—*Publ. Hlth Rep.* **62** no. 30 pp. 1085–1095, 2 graphs, 1 ref. Washington, D.C., 1947.

An account is given of the successful use of DDT in oil to control larvae of *Anopheles quadrimaculatus*, Say, in 1945 in an area surrounding a naval base in Tennessee that for three years had proved difficult to cover with oil larvicide by the usual techniques, many of the streams, ponds and ditches being large, overgrown and difficult to cross. The work involved training the operators to apply as little as 5 U.S. gals. solution per acre with the usual oiling equipment. The results were satisfactory as compared with 1944, and indicated that 1 or 2 per cent. DDT in oil, applied at intervals of 7–9 days and 5 U.S. gals. per acre, gave effective control with a saving of 40 per cent. in over-all cost as compared with ordinary oiling, but that the DDT had little or no lasting effect. Populations rose during a period of about a month when DDT was omitted because of flushing by heavy rain, and numbers in the control zone were extremely high. The amounts of DDT used per acre may not represent the minimum that would give the results achieved, and they are known to be harmful to fish, but Anopheline control was of paramount importance in the circumstances.

In a canal with slowly flowing water where the usual control measures were particularly difficult and costly to apply and also ineffective, three methods of applying the solution were compared. These were discharging it as a mist from the windward side, discharging it as a mist or stream in unusually small quantities directly to the water surface, and pouring a predetermined quantity of it into the water at established intervals. The first method was impracticable and unsatisfactory. The second gave good results with some saving in costs, but the best results were obtained with the last. Using this method, 2 per cent. DDT in oil applied at 6 U.S. gals. (0·95 lb. DDT) per acre at points 1,000 ft. apart completely stopped Anopheline production with a saving of 80 per cent. in labour costs and 77 per cent. in material, as compared with treatment with fuel oil alone.

SEPULCRI (P.). **La campagna antimalarica con il D.D.T. nel 1946 nelle provincie venete.** [The Campaign against Malaria with DDT in 1946 in the Venetian Provinces.]—*Riv. Malariol.* **26** no. 4 pp. 163–182, 2 maps (1 fldg.), 6 graphs. Rome, 1947. (With a Summary in English.)

The author gives figures showing that there was a fivefold increase in the number of cases of malaria in Venetia in 1945 as compared with 1939. The endemic area is limited to the coastal belt, and a campaign to control the disease by spraying the interiors of buildings with DDT against Anophelines was begun in 1946 [*cf. R.A.E.*, B **38** 130]. The organisation and mode of operation of the campaign are described in some detail. A 5 per cent. solution of DDT in kerosene was used to give deposits averaging just under 1·5 gm. per sq. metre, and over 16,000 houses, cattle sheds, storehouses, granaries, etc., in over 20 communes in the Provinces of Rovigo, Venice and Udine were treated. These represented only the areas in which malaria was the most severe, and no treatment was applied in the Provinces of Verona, where only sporadic cases occur, and Padua, where the disease is very restricted. Spraying began in early May in the Province of Venice, and a month later in Rovigo and Udine, and it was finished by August. As a result, the case figures for the period May–October, which are shown in tables, were reduced by over half in each of the provinces, as compared with 1945. The figures for the treated areas alone would have been still better.

Observations on Anophelines were made between May and October in animal quarters and elsewhere and showed that few or none occurred in treated quarters, and fewer in unsprayed quarters in the treated areas than in districts outside these. Further evidence of the reduction in Anophelines was provided by the fact that hay lofts in the treated areas contained hardly any hibernating females in November and December, even though close to untreated animal quarters, while those outside the areas contained many.

Some inconvenience in carrying out the work was caused by the presence of silkworms [*Bombyx mori*, L.], which proved very susceptible to DDT [*cf.* A **38** 391], so that some areas could not be treated at the desired time.

The disease showed a tendency to spread in Rovigo, probably owing to the development of methane wells [*cf.* B **36** 62], and it was planned to extend the campaign to include these districts in 1947 and also parts of the Province of Padua, where there was also some increase.

MONACI (V.). **L'esacerbazione dell'endemia malaria e l'anofelismo nel territorio di Venezia.** [The Increase in endemic Malaria and Anophelines in the Territory of Venetia.]—*Riv. Malariol.* **26** no. 4 pp. 191–211, 1 map, 1 graph, 5 refs. Rome, 1947. (With a Summary in English.)

In view of the recrudescence of malaria in the Venetian provinces of Italy that began in 1940–41 as a result of war conditions [*cf.* also preceding abstract], observations were carried out in 1943–44 on the distribution of Anophelines in districts near Venice [*cf. R.A.E.*, B **25** 289 ; **36** 61]. Catches were made in bedrooms and animal quarters at closely spaced points up the valleys of several of the main rivers and along other waterways to the north and south of the Lagoon and repeated at intervals, and the salinity of the water and (in 1944) its temperature were recorded. Females of *Anopheles maculipennis*, Mg., were kept in the laboratory for oviposition. The topography of the district and its agricultural conditions are described, and the results are shown in tables and discussed. The author's main conclusions are as follows. While *A. maculipennis* var. *typicus* was uniformly distributed irrespective of the salinity of the water, var. *messeae*, Flni., occurred in districts in which the water was poor in chlorine and var. *sacharovi*, Favr (*elutus*, Edw.) in those in which it was rich [but *cf.* **38** 131]. Occurrence was influenced by season, *A. maculipennis* vars. *typicus* and *messeae* beginning to oviposit in February, var. *sacharovi* and *A. claviger*, Mg. (*bifurcatus*, auct.) in late March or April and var. *melanoon*, Hackett, not until July or August. All forms occurred in rooms and animal quarters, with some preference for the latter. The commonest were vars. *typicus*, *messeae* and *sacharovi*, and though the first two were widely distributed, *sacharovi* became uncommon with increasing distance inland and did not occur beyond the limits of the endemic coastal area. Its frequency was strikingly correlated with that of malaria.

SCHWETZ (J.). **Sur les anophèles et le paludisme endémique et epidémique des noirs dans les régions de hautes altitudes de l'Afrique intertropicale.**—*Riv. Malariol.* **26** no. 5 pp. 227–233, 6 refs. Rome, 1947.

Although malaria did not formerly occur in the Belgian Congo at altitudes above about 5,900 ft., owing to the absence of suitable Anopheline vectors [*cf. R.A.E.*, B **32** 97], the land reclamation schemes that have been intensively pursued on the plateaux of Ruanda-Urundi since 1943 have led to the formation of favourable Anopheline breeding places at high altitudes and epidemics of acute malaria. These have been accentuated by the increased mobility of the native population. Lists are given of the Anophelines taken at typical localities at different altitudes, together with a list showing that *Anopheles pharoensis*, Theo., occurred at 3,600–5,000 ft., *A. gambiae*, Giles, *A. funestus*, Giles, *A. marshalli*, Theo., *A. coustani*, Lav., *A. christyi*, Newst. & Cart., *A. squamosus*, Theo., *A. demeilloni*, Evans, and *A. implexus*, Theo., at 3,600–5,900 ft., and *A. christyi*, *A. demeilloni* and *A. garnhami*, Edw., at 5,900–6,500 ft. and above. Most of the native settlements are at 5,575–5,900 ft., and are thus on the upper edge of the zone in which known vectors of malaria were found. There may have been some weak endemic malaria among them, and if so, it is now apparent that cases of acute malaria can co-exist with it. It is thought that with time, the disease will affect the whole native population. It will become sub-acute and finally endemic, and the most that can be done to control it with the present facilities is to accelerate the passing of the acute phase by the appropriate use of drugs and selected drainage schemes, possibly combined with the use of modern insecticides.

Patrissi (T.). **L'eradicazione degli anofeli dalla Sardegna. (Considerazioni critiche.)** [The Eradication of Anophelines from Sardinia. (Critical Considerations.)]—*Riv. Malariol.* **26** no. 5 pp. 248–254. Rome, 1947. (With a Summary in English.)

A plan was set on foot to eliminate malaria from Sardinia by eradicating its Anopheline vectors, *Anopheles maculipennis* vars. *labranchiae*, Flni., and *sacharovi*, Favr (both of which the author treats as distinct species) and *A. superpictus*, Grassi [*cf. R.A.E.*, B **38** 130]. This was to be done by spraying with DDT against the adults in buildings in the autumns and winters of 1946–47, 1947–48 and 1948–49 and against the larvae in their breeding places in 1947 and 1948 ; final inspections of breeding places were to be made in 1949 to ascertain whether larvae still occurred. The plan differed from that in operation on the mainland of Italy and in Sicily [*cf. loc. cit.*], where the object was to eradicate the domestic vectors by means of house-spraying only, and the author here discusses various factors that might prejudice its final success. These include the known difficulty of eradicating a well-established species, in contrast to maintaining it below a dangerous level, the shortness of the period in which it was proposed to achieve eradication, the danger of reinvasion if favourable breeding conditions were permitted to remain, so that an expensive organisation would be required to enforce a quarantine and carry out inspections, and the possible development of strains of the Anophelines resistant to DDT.

Okan (S.). **Malaria Control in Turkey.** [*In Turkish and English.*]—*Sağl. Sosy. Yard. Bakanl. Yayın.* no. 143, 67 pp., 27 figs., 4 graphs, 2 col. fldg. maps. Ankara, 1949.

The official organisation of malaria control in Turkey [*cf. R.A.E.*, B **28** 87], which is described, was revised in 1945–46 and has now been extended to cover three-quarters of the country. In addition to the distribution of drugs and hospital treatment, the work involved includes the control of Anophelines. DDT became available for this purpose in 1946 and is now used as a 5 per cent. spray, in oil or emulsified solution, against adults in houses and animal quarters, and as a 2 per cent. solution in fuel oil against larvae in marshland. Buildings are usually sprayed three times a year, before the Anophelines leave their winter quarters in spring, two or three months later (early summer) and in autumn or early winter, but this scheme is modified to suit local climatic and other conditions, more or fewer applications being made as required. Over 70 tons of DDT was used in 1948, and although rainfall was heavy and outbreaks of malaria would normally have been expected, the incidence of the disease was less than in previous years.

Hairston (N. G.), Bang (F. B.) & Maier (J.). **Malaria in the Natives of New Guinea.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 6 pp. 795–807, 1 map, 5 graphs, 4 refs. London, 1947.

Bang (F. B.), Hairston (N. G.), Maier (J.) & Roberts (F. H. S.). **DDT Spraying inside Houses as a Means of Malaria Control in New Guinea.**—*T. c.* pp. 809–822, 2 graphs, 8 refs.

In the first paper, the results are given of parasite and spleen surveys made in nine widely separated areas in eastern New Guinea and the Admiralty Islands in 1944 to determine the intensity of hyperendemic malaria. It was necessary to classify children into age groups in order to compare transmission in hyperendemic areas ; two villages showed spleen rates of 68 and 94 per cent., respectively, in children, but transmission was so intense in the first village that the rate was highest in infants under two years old, whereas the peak in the second was not reached until the 6–10 years age group. Surveys at another place showed a higher rate of transmission in February (the height of the wet season) than in October, the end of the dry season ; this is attributed to difference in rainfall as temperature does not vary enough to have any effect. At the end of the dry season, breeding of Anophelines was at a minimum. The surveys indicated that hyperendemic malaria can be maintained in New Guinea in the absence of "man made" breeding places, since nearly all the villages studied are well away from military areas and roads where such breeding places exist.

In the second paper, an account is given of the effect of applying 100 mg. DDT per sq. ft. as a 4 per cent. solution in kerosene to the interior walls of houses in a native village in Papua in September 1944 as an anti-malaria measure. A comparable village served as an untreated control. They had about the same amount of malaria, and both had very low infection rates in Anophelines. The two species found were *Anopheles farauti*, Lav. (*A. punctulatus moluccensis*, Sw. & Sw.) and *A. subpictus*, Grassi, which were about equally plentiful in night catches in the treated village. Gut infections were found in both and gland infection in the former, but dissections were not extensive enough to determine the relative importance of the two species. Precipitin tests, however, indicated that *A. subpictus* feeds on man at least as readily as *A. farauti*. As elsewhere in the area, hyperendemicity is maintained by the very large numbers of Anophelines.

Investigation four months after treatment showed that the parasite and spleen indices had increased in all age groups in the control village, whereas there was a slight decrease, not statistically significant, in the parasite index in the treated village, and no appreciable change in the spleen index. At the same time, the numbers of adult Anophelines found per house averaged 1·7 in the treated village, 24·2 in the control village and 48·3 and 17 in two other untreated villages not far away. It was not possible to determine the effect of spraying on the infection rate in mosquitos as the rate before spraying was too low. The importance of spraying the interiors of native houses with DDT in villages near military installations as an anti-malaria measure for the protection of troops is confirmed. As *A. farauti* has been found resting in tents, spraying the interior of tents is also recommended.

WILSON (D. B.) & ROBERTSON (A. G.). **DDT Airspray in Malaria Control in East Africa.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 6 pp. 823–850, 10 figs., 5 refs. London, 1947.

Accounts are given of observations made in Tanganyika in April–June 1945 and in Kenya in July–September on the use of DDT in a spray applied from aeroplanes against larvae of *Anopheles gambiae*, Giles, and *A. funestus*, Giles. Both sets of operations were intended as practical anti-malaria measures. Materials and methods are described in detail, and weather conditions are discussed. The sprays consisted of crude DDT in oil at concentrations estimated to give 4 and 5 per cent. p,p′DDT for the tests in Tanganyika and Kenya, respectively. In Tanganyika, the spray was applied at a rate equivalent to 17 mg. p,p′DDT per sq. metre, and this proved to be inadequate, giving results little better than those obtained by standard ground control methods. The rate was increased to 32 mg. in Kenya, and this effected an immediate reduction of 97 per cent. in *Anopheles* larvae taken at larval catching stations, with further decrease later. There was also an immediate reduction of 98 per cent. in adults taken at adult catching stations (each consisting of 3–5 African huts), which strongly suggested action against adults also. However, direct evidence of adult kill was not obtained, and none was expected in view of the large size (mainly 0·1–1 mm.) of the spray droplets used. It is concluded, although it was not conclusively demonstrated, that breeding of *A. gambiae* at the height of the season was effectively, if not completely, checked. This conclusion was based on the slow rate at which catches of vectors in houses rose after treatment, the change in relative numbers of *A. gambiae* and *A. funestus* in these catches, and comparison with previous years. The radius over which control measures should be extended against *A. gambiae* and *A. funestus* is discussed at some length, and evidence is provided that 1½–2 miles is adequate. Incomplete control with ground spraying appeared to be the result of some breeding places being missed rather than of failure to treat a sufficiently wide area.

The main advantages of spraying from the air are speed and the increased chance of covering all breeding places. To do this, it is necessary to allow for changes in the direction and speed of the wind. On this account and because of interference with penetration to the surface of the water by vegetation, a high dosage must be used. More than double the amount necessary on the water surface is required when vegetation is thick. Vegetation did not appear seriously to impede the spread of spray that reached the water surface. An interim conclusion is reached that the practical minimum amount of DDT that should be put down is more than 22 mg. per sq. metre. A further cause of uncertain distribution lies in the nature of the drop spectrum of the spray. This can probably be overcome by wide overlapping of swathes with a reduced rate of spray emission. Fish were not affected by one application of DDT at 32 mg. per sq. metre, but there was some mortality following seven applications. However, it is considered that spraying from the air over the limited areas to be covered in practical malaria control is unlikely to cause any serious upset of the balance as a whole.

FLEMING (R. F.) & FRENCH (J. M.). **Dengue in Iraq.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 6 pp. 851–860, 5 refs. London, 1947.

Records are given of a series of cases of dengue fever observed in Baghdad in the autumn of 1944 and thought to be the first from Iraq. *Aëdes aegypti*, L., one of the known vectors, was observed to be present.

SNIJDERS (E. P.), POLAK (M. F.) & HOEKSTRA (J.). **Jungle Yellow Fever in Surinam.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 6 pp. 861–868, 15 refs. London, 1947.

Serological research has shown that as regards the epidemiology of yellow fever, Dutch Guiana consists of three regions. These are the hinterland, covered with primeval forest and inhabited by bush-negroes and Indians, where jungle yellow fever prevails and human infection is relatively frequent, but bush-negresses rarely acquire the infection although their homes are in the forest ; the agricultural regions on the coast and plantations situated near the forest, where human infection with yellow fever, probably mostly of the jungle type, is fairly common, but epidemics have never been observed though *Aëdes aegypti*, L., is abundant ; and the capital, Paramaribo, where there are no indications that yellow fever has prevailed since 1909, but where the introduction of the virus is possible on account of close contact with the agricultural region and visits by inhabitants of the jungle, and where it might be expected to cause a severe epidemic on account of the prevalence of *A. aegypti*. There was evidence that epidemics in Paramaribo in 1902 and 1908–09 did not penetrate the jungle.

KIRK (R.) & LEWIS (D. J.). **Studies in Leishmaniasis in the Anglo-Egyptian Sudan. IX. Further Observations on the Sandflies** (*Phlebotomus*) **of the Sudan.**—*Trans. R. Soc. trop. Med. Hyg.* **40** no. 6 pp. 869–888, 2 figs., 2 maps, 44 refs. London, 1947.

Sandflies collected in the Anglo-Egyptian Sudan since 1938 include 12 named species and varieties in addition to the 13 recorded in the authors' previous paper [*R.A.E.*, B **28** 201]. Other material believed to represent new species is not here considered. Notes are given on the local distribution and sometimes habits of the 25 named forms. In the case of those previously recorded, only additional localities are given. Collections were made with oiled (slightly adhesive) paper traps and traps baited with animals. Individuals and species from the wet, forested southern parts of the Sudan were darker than those from the arid north. Unspecified mites were found on examples of four species, and a fungus in one named and one undescribed species.

Flagellates of Sudan kala-azar (visceral leishmaniasis) undergoing " anterior " development were found in individuals of *Phlebotomus langeroni* var. *orientalis*, Parr., that had fed on a patient with post-kala-azar dermal leishmaniasis. This sandfly bites man very readily. It is the only member of the group of *P. major*, Annan., with a distribution in the Sudan related to that of kala-azar. It is erratic and variable in its occurrence, and this may have some bearing on the erratic and variable appearance of the disease. The distribution of *P. clydei*, Sinton, one of the commonest and most widely diffused species in the Sudan, also corresponds roughly with that of kala-azar. It bites man both in and out of doors, but is essentially an outdoor species, probably feeding mainly on burrowing animals. In preliminary experiments, the development of flagellates was observed in one out of 40 individuals of this species fed on a patient with post-kala-azar dermal leishmaniasis, but the development was not of the " anterior " type. *P. clydei* and *P. papatasi*, Scop., were taken sucking human blood in the northern Sudan.

Conditions in the Sudan plains during the day in the dry season are too hot and arid to be suitable for *Phlebotomus*. At one typical place in the centre of the Gezira clay plain, the monthly mean temperature is above 30°C. [86°F.] from April to June and the monthly mean relative humidity 18–44 per cent. [*cf.* **25** 95]. In such places, sandflies are seen in the evening and at night only when temperatures are low and relative humidity high. It is concluded that in the black cotton soil or clay areas, they pass the day in a vast subterranean environment, consisting of holes and cracks in the ground. At a depth of 2 ft., the temperature is steady at 27°C. [80·6°F.] and the air in small cracks is practically saturated, so that by entering these a sandfly can reach approximately optimum conditions. Where the soil is lighter, animal burrows replace the cracks. Attempts to catch sandflies by placing oiled paper traps over the cracks seldom failed, and large numbers could almost invariably be caught by placing the traps over the mouths of animal burrows. It is not known whether the sandflies breed in the cracks or what becomes of them in the wet season.

NIELSEN (E. T.) & GREVE (H.). **Studies on the Swarming Habits of Mosquitos and other Nematocera.**—*Bull. ent. Res.* **41** pt. 2 pp. 227–258, 3 pls., 15 figs., 9 refs. London, 1950.

The following is the authors' summary of observations made in Denmark in 1938–40 and 1945–48. The principal object of this work was to elucidate the swarming behaviour of *Aëdes cantans*, Mg., and other mosquitos, *Chaoborus crystallinus*, Deg., and certain Chironomids. In addition, ancillary studies were made of the general ecology of these species. The swarms were found to consist entirely of males and to bear no direct relationship to mating or to the search for food. There was no noticeable difference between the swarming habits of the different species of mosquitos and even the differences between the Culicids and Chironomids were very slight. Swarming was observed to take place at about sunset in the evening and sunrise in the morning. The evening swarms appeared to be formed in response to decreasing light intensity and to disperse at a light intensity of about 7 Lux. Low temperatures may delay the start of swarming. The morning swarms started at about the same threshold of light intensity and at this time also their duration was reduced by low temperatures. Below about 50°F. they were not formed at all. Atmospheric humidity appeared to be of minor importance.

MORRIS (M. G.). **The Persistence of Toxicity in DDT-impregnated Hessian and its Use on Tsetse Traps.**—*Bull. ent. Res.* **41** pt. 2 pp. 259–288, 3 graphs, 6 refs. London, 1950.

The following is based on the author's summary of work undertaken in the Gold Coast with a view to improving the efficiency in catching *Glossina* of hessian-covered " animal " traps [*R.A.E.*, B **37** 110] by treating them with an insecticide to leave a toxic residue [**37** 112]. Experiments were begun in September 1946 to investigate the persistence of toxicity to *Glossina* (almost entirely *G. tachinoides*, Westw.) of hessian impregnated with DDT and exposed to the normal weather conditions of the inland savannah region ; also to establish a satisfactory method of estimating the loss or change in its toxicity, and to study the effects of impregnation with DDT on the efficiency of the traps. Hessian was impregnated by being soaked for ten minutes in a filtered saturated solution of commercial DDT in kerosene, which gave a deposit of 4·4 gm. DDT per sq. ft., and toxicity was tested at intervals with batches of *G. tachinoides*, which were kept in contact with the hessian for 15 or 60 seconds. The comparison of the survival times of these flies with those of controls showed an appreciable toxicity to remain after 20 weeks' full exposure to weather including 4·26 ins. of rain, a slight toxicity after 30 weeks, and a negligible toxicity after one year including 34·35 ins. of rain. A similarly treated cloth produced toxic symptoms in *Glossina* brought into contact with it for 15 seconds after it had been exposed for one year to wind and daylight, but protected from rain and direct sunlight. The difference between the results from contact for 15 and 60 seconds was not great. There was great diversity in individual survival times. Females survived slightly longer than males. Survival times lengthened in October when the humidity was high, but were shortened in December when conditions became hotter and drier.

In a further experiment, samples of hessian bearing 4·4 gm. DDT per sq. ft. (standard hessian) and of hessian soaked twice (super-impregnated), bearing 7·4 gm. DDT per sq. ft., were exposed to the weather for six months and others were kept as controls. Contact for 30 seconds with the super-impregnated hessian was invariably fatal to *G. tachinoides*. It is calculated that the standard cloth was 82 per cent. as toxic as the super-impregnated, and flies that received a lethal dose from it generally took longer to die. It was survival time, not toxicity, that varied with seasonal conditions. A full analysis of the survival times from exposed samples in relation to those from the control samples showed that exposure to weather during late rains followed by dry-season conditions caused only a slight though progressive deterioration of killing power. This amounted to 10 per cent. in 3–4 months, including 7·42 ins. of rain in the case of the standard hessian and 10 per cent. in six months with the same amount of rain in the case of the super-impregnated. Hessian impregnated with an emulsion concentrate consisting of 18 per cent. DDT, 58 per cent. naphtha and 24 per cent. emulsifier, undiluted or at dilutions of

25 or 50 per cent., was found to be highly toxic and to retain its effectiveness satisfactorily for at least 12 weeks' exposure in the dry season. Hessian freshly impregnated with DDT in kerosene solution caused flies to die more quickly as long as traces of kerosene persisted, but moisture interfered with the action of DDT unless kerosene was also present.

An "animal" trap covered with standard impregnated hessian caught over 40 per cent. more *G. tachinoides* and *G. palpalis*, R.-D., in 20 weeks than a similar trap without DDT. The superiority of the treated trap was lost in October but recovered in December. Presumably, considerable numbers of flies escape from the cage of an untreated trap.

Comparisons of catches made during the practical use on a small scale of traps covered with standard impregnated hessian and hessian sprayed with the emulsion concentrate at 25 per cent. showed that, although the emulsion sometimes gave better initial results, its superiority relative to the standard impregnation tended to diminish or disappear, especially during the wet season.

The increased efficiency of an impregnated trap is more than the measurable amount of the increased catches, since flies that have investigated the trap, but have not been caught, are likely to have received a lethal dose of DDT. The application of DDT to traps is an economical use of the insecticide, which can conveniently be applied in sufficient concentration to ensure that brief contacts will be fatal to tsetse over a period of several months.

MOGGRIDGE (J. Y.). **The Relations of the coastal Tsetse of Kenya to the Plant Communities.**—*Bull. ent. Res.* **41** pt. 2 pp. 301–315, 1 pl., 1 map, 2 refs. London, 1950.

The following is the author's summary of observations made between 1934 and 1939 on the relation of *Glossina pallidipes*, Aust., *G. austeni*, Newst., and *G. brevipalpis*, Newst., to different plant communities in the area round Kilifi, on the Kenya coast, which is described.

Under the conditions prevailing at Kilifi, *G. pallidipes* is evenly distributed throughout all vegetation types with the exception of cultivation, from which it is at all times almost entirely absent. There is a preference for the denser vegetation in the dry season, from which the tsetse spread out into the lighter vegetation in the wet and humid seasons. There is never at any time any concentration of *G. pallidipes* along the edges of extensive thicket or forest. The distribution of *G. austeni* is similar to that of *G. pallidipes* except that there is no tendency to spread into lighter vegetation in the wet season. There is some reason to think that *G. brevipalpis* prefers thicket of medium density and does not share with *G. austeni* a preference for tall heavy thicket. *G. pallidipes* was the only species staged for hunger [*cf. R.A.E.*, B **22** 25] except for *austeni* in the Sokoke forest. Males are replete at all seasons. *G. austeni* showed a remarkably large proportion of recently fed males.

Pupae and pupal cases of *G. pallidipes* were found on the floor of the coral rag thicket and forest. *G. austeni* and *G. brevipalpis* showed a preference for the undersides of large logs.

WILSON (S. G.). **A Check-list and Host-list of Ixodoidea found in Nyasaland, with Descriptions and biological Notes on some of the Rhipicephalids.**—*Bull. ent. Res.* **41** pt. 2 pp. 415–428, 18 figs., 11 refs. London, 1950.

A list is given of twelve species of *Rhipicephalus* (one of them represented by two varieties) and 15 ticks of other genera collected by the author in the Central and Northern Provinces of Nyasaland, showing the hosts on which each was taken. Collections on cattle were made weekly for three years, but collections from other hosts were more fortuitous. The principal species attacking cattle have already been noticed [*R.A.E.*, B **37** 107]. Descriptive notes are given on some of the species of *Rhipicephalus*, and also some brief biological notes supplementary to the data already recorded [*loc. cit.*].

Blanc (G.), Martin (L. A.) & Maurice (A.). **Présence du virus de la " Q. fever " dans le Maroc méridional.**—*Bull. Acad. Méd.* **131** no. 7–8 pp. 138–143, 2 figs., 16 refs. Paris, 1947.

The distribution of Q fever is reviewed from the literature [*R.A.E.*, B **37** 194–195, etc.], and the discovery of a focus near Goulimine in southern Morocco is recorded. No cases of the disease in man were found there, but three strains of the causal agent (*Rickettsia burneti*) were isolated from ticks identified as *Hyalomma savignyi*, Gerv. These ticks are widely distributed in the district on various domestic animals. The nature and properties of the causal agent, the identity of which was confirmed by cross-immunity tests, and the character of the disease produced in laboratory animals, particularly guineapigs, are described. Among local animals, *Meriones shawi*, *Xerus getulus* and *Aethechinus algirus* were found to be susceptible to infection, and ticks of three genera (*Hyalomma*, *Rhipicephalus sanguineus*, Latr., and *Ornithodoros erraticus*, Lucas) were easily infected experimentally.

PAPERS NOTICED BY TITLE ONLY.

Steiner (G.). **Fallenversuche zur Kennzeichnung des Verhaltens von Schmeissfliegen gegenüber verschiedenen Merkmalen ihrer Umgebung.** [Bait-trap Tests to determine the Reaction of Blowflies to various Characteristics of their Environment (olfactory and visual stimuli).]—*Z. vergl. Physiol.* **31** pt. 1 pp. 1–37, 14 figs., 28 refs. Berlin, 1948. [See *R.A.E.*, B **36** 25.]

Knight (R. L.) & Boyns (B. M.). **Agricultural Science in the Sudan. A Bibliography with Abstracts** [including papers on Arthropods injurious to man and domestic animals].—$8\frac{3}{4}\times5\frac{1}{2}$ ins., 251 pp. Arbroath, T. Buncle & Co. Ltd., 1950. Price 20*s*.

Marsden (S. J.) & Bird (H. R.). **Effects of DDT on growing Turkeys.**—*Poult. Sci.* **26** no. 1 pp. 3–6, 1 fig., 2 refs. Menasha, Wis., 1947. [See *R.A.E.*, A **38** 491.]

Rubin (M.), Bird (H. R.), Green (N.) & Carter (R. H.). **Toxicity of DDT to laying Hens.**—*Poult. Sci.* **26** no. 4 pp. 410–413, 7 refs. Menasha, Wis., 1947. [See *R.A.E.*, A **38** 491.]

Riemschneider (R.). **Der o,m′-DDT-Wirkstoff.** [The o,m′ Isomer of DDT.]—*Angew. Chem.* **61** no. 8 p. 333, 3 refs. Berlin, 1949. [See *R.A.E.*, A **38** 473.]

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